Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
Nàdar air fad airson Alba air fad

Overview of the Scottish marine Special Protection Area selection process

Version Control

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Contents

1 Introduction

The purpose of this paper is to provide an overview of the site selection process undertaken by Scottish Natural Heritage (SNH) for the Scottish marine proposed Special Protection Areas (SPA). The paper summarises the legislative background for marine SPAs, the marine bird interests relevant to the UK and Scotland and the purpose and conservation benefits of the Scottish marine SPAs.

The focus of the paper is to explain how the evidence was used to identify potential sites, the stages and steps involved in the application of the UK SPA Selection Guidelines (JNCC, 1999), and the decisions made in the final preparation of the 15 proposed SPAs (pSPAs) submitted to Scottish Government in June 2016. The paper presents the sequence of the process in chronological order as far as possible, however it should be noted that some areas of work were carried out in parallel.

The paper does not reflect potential changes to the pSPAs as a result of the public consultations in 2016/17. These will be presented to Marine Scotland in a consultation report along with SNH's final advice on the network of SPA proposals.

2 Legislative framework and SPA Review

SPAs are classified under the Birds Directive (EC Directive on the conservation of wild birds (2009/147)) to protect rare, vulnerable and migratory wild birds.

The Birds Directive was adopted in 1979 (as 79/409/EEC)[1] by EU Member States due to increasing concerns over declines in Europe's wild bird populations caused by pollution, loss of habitats and unsustainable exploitation. The Birds Directive recognises that wild birds, many of which are migratory, are a shared heritage of the member states and that their conservation needs international co-operation.

A key component of the Birds Directive is for Member States to establish a national network of SPAs, on land and at sea, as one of several conservation measures that contribute to the protection of rare, vulnerable and migratory bird species.

Article 4.1 of the Birds Directive requires that species listed in Annex I (considered to be rare and vulnerable) should be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. The Birds Directive states that "*Member States shall classify in particular the most suitable territories in number and size as special protection areas for the conservation of these species, taking into account their protection requirements in the geographical sea and land area where this Directive applies*".

Article 4.2 of the Birds Directive further requires that "*Member States shall take similar measures for regularly occurring migratory species not listed in Annex I, bearing in mind their need for protection in the geographical sea and land area where this Directive applies, as regards their breeding, moulting and wintering areas and staging posts along their migration routes*."

For the last three decades, the requirements of the Birds Directive have been a major driver of UK bird conservation action. In particular, the programme of SPA identification, classification and subsequent management is long established in the terrestrial environment,

[1] In 2009, a consolidated Birds Directive (2009/147/EC2) replaced the 1979 Directive.

with the Scottish terrestrial network including breeding seabird colony SPAs and estuarine SPAs for some sea duck and grebe species.

In 1993, the Department of the Environment commissioned a 'definitive' review of the UK SPA network. This Review (Stroud *et al.,* 2001) identified a number of areas where further work was required to complete the SPA network in the UK. Several groupings of bird species were identified where SPA provision remained incomplete for a range of reasons - typically lack of data. These included: "*birds in the marine environment*". Subsequently, EU guidance (2007) was also published on the implementation of the Habitats and Birds Directives in the marine environment.

The Scottish Government is committed to identifying a network of SPAs in the marine environment. The programme of classifying marine SPAs in Scotland is already well underway. To date, 31 marine extensions to seabird colonies have been classified in Scottish waters. These extensions are a crucial step forwards in the conservation of breeding seabirds, providing protection of the seas immediately surrounding the colony and used by seabirds (including fulmar, gannet, puffin, guillemot, razorbill and/or Manx shearwater) for maintenance and socialization behaviours such as preening, displaying, rafting, roosting and bathing (Webb *et al.*, 2004). Some estuarine SPAs also provide protection for marine habitats above the Mean Low Water Springs (MLWS) used by divers, sea ducks, grebes and some seabird species (e.g. cormorant and Sandwich tern).

This significant progress, however does not fully meet all the lifecycle needs of seabirds and waterfowl whilst in Scottish waters. In particular, the Scottish marine SPA network does not include subtidal marine habitats used by breeding and non-breeding seabirds and some species of divers, grebes and sea ducks that spend their winter in Scottish waters. Foraging areas used by breeding red-throated diver are also not represented in the Scottish SPA network.

The European Commission has advised it also considers elements of the UK SPA network to be incomplete with the marine component requiring further attention (EU Pilot case 4317/12/ENVI and 8354/16/ENVI (2012, reiterated in 2016).

The proposed Scottish SPA network aims to represent a network of sites within the UK geographical network taking account of the distribution of marine birds within UK waters and any specific role Scotland may have for species only or predominantly occurring in Scottish waters (e.g. non-breeding great northern diver and breeding red-throated diver).

3 Identifying marine birds requiring SPA provision

The UK's geographic position – a north temperate island close to a major continental land-mass – results in its particular European importance for a number of groups of birds. The importance of the UK for birds which spend all or part of their lives around our coasts is well recognised, particularly in Scotland (Mitchell et al., 2004). The SPA Review 2001 (Stroud et al., 2001) makes specific reference to the "outstanding importance" of the UK's breeding seabirds and wintering areas for many waterfowl.

EU guidance (2007) on the establishment of SPAs in the marine environment sets out the groups of marine birds for which SPAs should be considered. These include seabirds (fulmars, petrels, shearwaters, storm-petrels, gannets, cormorants, skuas, gulls, terns and auks) and waterfowl (sea ducks, divers and grebes).

There are over 500 bird species (EU Bird List and Read-me note (European Commission, 2015)) covered by the Birds Directive (*bird species naturally occurring in the wild state in the European Territory of the member states to which the Treaty applies*), as agreed by member

states. Of these, 106 (British Ornithologist's Union British List 2000) are thought to use UK marine waters, of which 45 occur in numbers greater than 50 each year and are dependent on the marine environment. For these species, benthic and pelagic habitats (from the sea bed through the water column to the sea surface) coastal and offshore play a vital role in their life-cycles (supplying food, shelter, habitat for social activities and migration routes). All of the 45 species, except one (black guillemot[2]), are either rare or vulnerable bird species (15 species on Annex 1) or regularly occurring migratory species (29 species). This means the UK is obliged to take account of the requirements of Articles 4.1 and 4.2 (see section 2 above) of the Birds Directive for each of these 44 species.

Marine birds (Annex 1 and migratory) use a variety of benthic and pelagic habitats, for a variety of purposes. Such usage occurs throughout the year and the EU considers that areas of particular importance should be considered for inclusions as SPA (EU guidance (2007).

The four broad types of marine SPAs outlined in the EU guidance that should be considered by Member States are:

- *Extensions to existing terrestrial SPAs in the marine environment.*
  These are extensions to seabird colony SPAs because the birds protected in these SPAS make extensive use of the adjacent waters around the colonies for a wide range of purposes such as maintenance behaviours (preening, rafting).

- *Inshore areas used by aggregations of waterfowl during the non-breeding season.*
  Sea ducks, divers and grebes that form aggregations at predictable locations for resting, moulting and feeding.

- *Areas used by seabirds for foraging or any other type of aggregations.*
  Seabird concentrations, particularly where birds are foraging, that may be associated for instance with highly productive fronts, current or upwellings.

- *Migratory hotspots*
  Includes areas where birds gather or travel in significant and regularly occurring concentrations during migration.

In taking forward these four broad types of marine SPAs, the approach outlined for terrestrial SPAs in the SPA Review (Stroud et al., 2001) was instrumental in initial decisions by the Statutory Nature Conservation Bodies (SNCBS) on which species should (if meeting the thresholds for selection) be included in a UK network of marine SPAs. The SPA Review identified three categories of bird species where site-based measures are not an appropriate protection mechanism, or it is simply not feasible to identify the most suitable territories. The 3 categories of species for which SPAs are not considered appropriate are:

a) *"Migratory species that are broadly dispersed and do not occur in significant aggregations."*

With respect to the dispersion of marine birds, a range of factors influence bird distribution at sea. There is often a strong association with habitat features (water depth, fronts etc.) and the distribution of prey is a major determinant of distribution of feeding birds. Such factors governing the distribution of birds at sea along with the biology and ecology of the birds

[2] Black guillemots are not migratory in the UK, or listed on Annex 1 of the Birds Directive. Nature Conservation Marine Protected Areas were designated in August 2014 for black guillemot.

themselves determines the spatial nature of bird concentrations; with some species forming large flocks (e.g. long-tailed duck, eider), others being loosely aggregated (e.g. divers, shag) and some being broadly dispersed (e.g. glaucous gull in UK waters). For species that aggregate, marine SPAs are likely to play an important role in protecting the marine habitats and prey these birds rely on, as well as increasing their resilience to wider-scale impacts. Marine SPA provision was therefore considered an appropriate conservation measure for species where aggregations are identified (see section 4).

b) *"Species that are sedentary year-round (i.e. non-migratory)."*

Black guillemot is the only non-migratory species and was not considered for SPA provision.

c) *"Non-native species*."

No non-native species have been considered for SPA provision.

In addition to the four broad types of marine areas identified in the EU guidance, foraging areas for breeding red-throated diver (Annex 1 species) have also been considered. Scotland holds the entire UK breeding population, approximately 30% of the EU breeding red-throated diver population. There are ten terrestrial SPAs protecting the nesting sites of red-throated diver. These SPAs however do not include the protection of the marine habitats or prey in their foraging areas that they depend upon for their survival and breeding success.

Table 1 summarises the marine SPAs that have already been classified in Scotland for the 44 marine species.

Table 1: Existing network of SPAs in Scottish waters

Species (occurring in numbers greater than 50 in UK waters)	**Annex 1 species or regularly occurring migratory (rom) species**	**Occurring in existing Scottish SPAs with marine components**				**Potential gaps in the Scottish marine SPA network (below the MLWS)**
		Estuarine SPAs (above Mean Low Water Springs (MLWS) only) **(No. of SPAs)**		**Marine extension to colony SPA – for maintenance behaviours during the breeding season**[3] (preening, displaying, roosting) **(No. of SPAs)**		
		Breeding season	**Non-breeding season**	**Colony species determining the extension**	**Colony species not determining the extension**[4]	
Waterfowl						
Red-throated diver	Annex 1	0	1	0	0	Non-breeding season aggregations and foraging areas used by breeding birds
Black-throated diver	Annex 1	0	0	0	0	Non-breeding season aggregations
Great northern diver	Annex 1	0	0	0	0	Non-breeding season aggregations
Slavonian grebe	Annex 1	0	1	0		Non-breeding season aggregations
Greater scaup	rom	0	5	0	0	Non-breeding season aggregations
Common eider	rom	0	3	0	0	Non-breeding season aggregations
Long-tailed duck	rom	0	3	0	0	Non-breeding season aggregations
Common scoter	rom	0	3	0	0	Non-breeding season aggregations
Velvet scoter	rom	0	3	0	0	Non-breeding season aggregations

[3] Because of their relatively restricted extent (1 km for auks, 2 km for fulmar and gannet and 4 km for Manx shearwater) marine extensions to breeding colony SPAs do not protect the spatial extent of the birds' foraging areas.

[4] These species are qualifying features of the colony SPA but are not the species for which the subsequent marine extension was classified. All qualifying species of the colony SPA however are protected throughout the entire extent of the SPA, including the extension.

Common goldeneye	rom	0	4	0	0	Non-breeding season aggregations
Red-breasted merganser	rom	0	4	0	0	Non-breeding season aggregations
Goosander	rom	0	5	0	0	Non-breeding season aggregations
Great crested grebe	rom	0	2	0		Non-breeding season aggregations
Seabirds						
Cory's shearwater	Annex 1	0	0	0	0	None (species not regularly occurring in Scottish waters)
Sooty shearwater	Annex 1	0	0	0	0	Foraging areas used by non-breeding birds
Manx shearwater	rom	0	0	2	0	Foraging areas used by breeding birds
Balearic shearwater	Annex 1	0	0	0	0	None (species not regularly occurring in Scottish waters)
European storm petrel	Annex 1	0	0	0	2	Foraging areas used by breeding birds
Leach's storm petrel	Annex 1	0	0	0	5	Foraging areas used by breeding birds
Northern fulmar	rom	0	0	23	0	Foraging areas used during the breeding and non-breeding seasons
Northern gannet	rom	0	0	8	0	Foraging areas used during the breeding and non-breeding seasons
Great cormorant	rom	0	4	0	3	Foraging areas used during the breeding and non-breeding seasons
European shag	rom	0	0	0	11	Foraging areas used during the breeding and non-breeding seasons
Arctic skua	rom	0	0	0	6	Foraging areas used by breeding birds
Great skua	rom	0	0	0	8	Foraging areas used by breeding birds

Black-legged kittiwake	rom	0	0	0	28	Foraging areas used during the breeding and non-breeding seasons
Black-headed gull	rom	0	0	0	0	Non-breeding season roosts
Little gull	Annex 1	0	0	0	0	Non-breeding season aggregations
Mediterranean gull	rom	0	0	0	0	None (species not regularly occurring in Scottish waters)
Common gull	rom	0		0	0	Non-breeding season roosts
Lesser black-backed gull	rom	0	0	0	2	Foraging areas used during the breeding and non-breeding seasons; Non-breeding season roosts
Herring gull	rom	0	0	0	8	Foraging areas used during the breeding and non-breeding seasons; Non-breeding season roosts
Iceland gull	rom	0	0	0	0	None (species occurs irregularly in small numbers in Scottish waters)
Glaucous gull	rom	0	0	0	0	None (species occurs irregularly in small numbers in Scottish waters)
Great black-backed gull	rom	0	0	0	5	Foraging areas used during the breeding and non-breeding seasons
Little tern	Annex 1	2	0	0	0	Foraging areas used by breeding birds
Sandwich tern	Annex 1	0	1 (passage)	0	1	Foraging areas used by breeding birds
Common tern	Annex 1	2	0	0	2	Foraging areas used by breeding birds
Arctic tern	Annex 1	1	0	0	6	Foraging areas used by breeding birds
Roseate tern	Annex 1	0	0	0	1	Foraging areas used by breeding birds
Common guillemot	rom	0	0	30	0	Foraging areas used during the breeding and non-breeding

						seasons
Razorbill	rom	0	0	16	0	Foraging areas used during the breeding and non-breeding seasons
Little auk	rom	0	0	0	0	Foraging areas used by non-breeding birds
Atlantic puffin	rom	0	0	15	0	Foraging areas used during the breeding and non-breeding seasons

4 Conservation benefits of marine protected areas for marine birds

In the marine environment the overarching purpose for protected areas are perhaps best captured in the stated aims of the OSPAR network of marine protected areas, which are broadly:

i. 'to protect, conserve and restore species, habitats and ecological processes which have been adversely affected by human activities;

ii. to prevent their degradation following the precautionary principle; and

iii. to protect and conserve areas that best represent the range of species, habitats and ecological processes in the maritime area' (OSPAR Recommendation 2003).

Site-based protection ensures that the habitats and associated ecosystem processes that support these important populations of marine birds can be safeguarded in the long term. This approach is complementary to protection of individual bird species across their full range within Scottish seas and to wider seas measures beyond protected areas, such as sustainable management of commercial fisheries and marine planning.

Well-managed protected areas are important to promoting the resilience of species and habitats to the impacts of climate change with larger areas of habitats and species populations providing better opportunities for sustaining diversity (SNH, 2016). Marine protected areas can also contribute to adaptation to climate change by reducing other pressures, reducing fragmentation and safeguarding supporting habitats (SNH, 2016).

4.1 Specific conservation benefits of SPAs

Scottish marine pSPAs have been selected on the basis of either the regular occurrence of notable aggregations of qualifying bird species or predicted usage of particular areas of sea by breeding birds from existing colony SPAs. Up to 21 species are represented within a single site. This approach has identified marine areas that are productive, driven by the underlying geophysical (e.g. bathymetry, substrate, currents) and associated biological (e.g. seabed habitats) characteristics necessary to support such large concentrations of birds throughout either the breeding or non-breeding seasons.

The conservation benefits that arise from SPA classification fall into 2 categories:

1. Providing a statutory requirement to assess all plans and projects that have the potential to have negative impact on the qualifying features of an SPA.

   SPAs are given legal protection by The Conservation (Natural Habitats, & c.) Regulations 1994 commonly referred to as the 'Habitats Regulations'[5]. The Habitats Regulations require all plans or projects that may cause an impact on a Natura site (SPA or Special Area of Conservation (SAC)) to be assessed against the conservation objectives for that site. This process is known as a Habitats Regulations Appraisal (HRA).

   An HRA is a rigorous statutory procedure that ensures adverse effects on site integrity are avoided. The integrity of the site only applies to the qualifying features and is directly linked to the conservation objectives for the site. If all of the

[5] For the offshore components of marine SPAs this protection is afforded through *The Conservation of Offshore Marine Habitats and Species Regulations 2017*.

conservation objectives are met, then the integrity of the site should be maintained. In cases where adverse effects on site integrity cannot be avoided, plans or projects can only be given consent or permission if there are no alternative solutions and the proposal can demonstrate imperative reasons of overriding public interest (this can include matters of a socio-economic nature).

The HRA process provides an opportunity to consider appropriate mitigation that can reduce impacts, avoid adverse effects and permit plans or projects to proceed having taken full account of the qualifying features of an SPA.

2. Implementing proactive *site-based* conservation measures to maintain or restore the conservation status of the qualifying species.

SNH's initial advice on management for the proposed SPAs was provided at consultation. Should the sites be classified, it will be up to regulators, in discussion with SNH and others, to determine whether conservation measures are required and, if so, to implement them.

Further details on the conservation benefits of site-based protection for the relevant bird interests are provided in Annex 1.

4.2 Protection of foraging areas

Classification of the foraging areas for breeding birds already protected by colony SPAs recognises the true value of the foraging areas for breeding birds and most significantly, the underlying marine environment and processes that support areas of high prey abundance. Without this protection these supporting habitats, the prey species and habitats supporting prey species within the foraging areas are not specifically taken into account when considering proposals that may affect them and indirectly, the breeding seabirds from colony SPAs that depend upon them.

The existing 31 marine extensions to seabird colony SPAs (classified in 2009) protect areas used for maintenance behaviours such as preening, bathing, and displaying by breeding seabirds adjacent to their colonies. The extensions are driven by a five species; common guillemot, Atlantic puffin, razorbill, northern fulmar and Manx shearwater and cover restricted areas, up to 4kms depending on the species. They are not designed to include the more extension areas used for foraging.

SPA status also places a surveillance and reporting responsibility on Statutory Nature Conservation Bodies. This means that any damage or deterioration to supporting habitat and/or prey abundance can be identified and conservation measures implemented to safeguard the relevant qualifying species. In addition, surveillance and reporting will mean that the impact of existing conservation measures can be verified.

5 Bird survey and analysis

The marine birds requiring action under the Birds Directive have differing ecologies, behaviours, distributions and abundances and occur in UK waters at different times of the year. In order to facilitate data collection and analysis across these differing interests, five[6] main areas of survey and analysis were undertaken for the relevant Annex I (rare and vulnerable bird species) and regularly occurring migratory species:

- inshore waterfowl aggregations during the winter,

[6] The work on identifying marine extensions for colony SPAs is considered complete in Scotland and therefore no additional work was proposed as part of this programme.

- seabird aggregations throughout the year,
- foraging areas for breeding terns,
- foraging areas for breeding red-throated divers, and
- foraging areas for European shag.

The Joint Nature Conservation Committee (JNCC) has been working over ten years (2001-2010) on behalf of all the Statutory Nature Conservation Bodies (SNCBs) to complete a programme of survey and analysis across the UK to inform advice on areas for potential selection of SPAs.

European Commission guidance[7] is clear that the data used for the selection of SPAs should be the best available evidence and the treatment of these data should follow scientific protocols. Advice and guidance on suitable data sources for the identification of areas for potential SPAs is provided in Johnston et al., 2002 and Reid et al., 2004. The protocols associated with these data sources have been applied consistently across the UK-wide programme of survey and analysis, using established scientific methods and best practice.

Existing data were used as much as possible. Where existing data were not suitable or not available, JNCC collected data or commissioned further data collection for the marine SPA identification process.

The different types of data sources used for the identification of areas for potential SPAs are set out below in Table 2. For inshore wintering waterfowl, in some cases, more than one dataset from different survey methods were available. In these cases, JNCC assessed the available data and selected the best available for each species and season using the decision tree illustrated in Figure 1. Preference was given to data that provided good spatial coverage of the Area of Search[8], collected systematically by experienced ornithologists and was the most recent data available at the time of analysis (Reid et al., 2004). Data that was potentially biased by external factors such as adverse weather conditions were excluded. JNCC have a clear audit of which data were selected in the different Areas of Search for calculating population estimates. In the vast majority of cases the decisions taken on which data to use are comprehensible and reproducible. In a very small number of exceptional cases, some expert judgement had to be applied; however, those cases follow a logical course of argument and can be explained fairly easily.

All datasets met the JNCC guidance and represent the best available evidence at the time of analysis.

Table 2: Type of survey and data collection period for each marine bird survey programme in Scotland.

Marine bird survey programme	Survey type used	Period of data collection
Waterfowl (non-breeding)	Aerial surveys	2001 - 2010
	Shore-based surveys	1998 - 2012
	Boat-based surveys	1998 - 2011
Seabirds (all seasons)	Boat transects - (European Seabirds at Sea (ESAS))	1980 - 2004

[7] http://ec.europa.eu/environment/nature/natura2000/marine/docs/marine_guidelines.pdf
[8] Initial area(s) identified as appropriate for searching for areas that may meet the Stage 1 UK SPA Selection Guideline population thresholds.

Marine bird survey programme	Survey type used	Period of data collection
Large terns (breeding)	Site specific tracking or generic model using tracking data	2006 - 2011
Little terns (breeding)	Boat transects	2011
	Shore-based surveys	2009 - 2011
Red-throated divers (breeding)	Generic model using tracking	2003 - 2007
European shag (breeding and non-breeding)	Site specific tracking	1980 - 2010
	Boat transect (ESAS)	1980 - 2004
	Shore-based and boat-based surveys	1998 - 2007

The key data requirement for an assessment of whether an area is suitable as a marine SPA is being able to show that relatively high numbers of a species occur at a particular location on a regular basis, compared to numbers for that species elsewhere. Marine areas with consistently high numbers of individuals are used as an indication of the importance of an area for birds. Recent data are used to confirm that observed bird aggregations remain present. However, for site selection purposes, it is more important to have sets of nationwide data that allow comparisons to be made over several years across the UK. This means that areas can be identified that have regularly occurring aggregations of birds that are consistent over time.

The principles for using evidence are provided in the supplementary consultation document: The principles guiding the evidence used in the identification of pSPAs in Scotland and summarised below:

Principle 1: Use suitable data to provide the required evidence
The identification and boundary setting of SPAs must be entirely based on scientific criteria. Accordingly, the proposed SPAs have been identified drawing upon data representing the best available scientific evidence on the abundance and distribution of seabirds and waterfowl in Scotland's marine environment. What constitutes 'best available evidence' will vary by species and the Area of Search; for example, data are likely to be more detailed for areas closer to the coast than for offshore areas.

Principle 2: Peer review of data and methods
JNCC have an evidence quality assurance policy which sets out principles for providing scientific advice and evidence. These principles include consideration of the suitability of the evidence for its intended use, robustness of analysis, and peer review of evidence and scientific advice.

The evidence used in the marine SPA identification process has received external peer review; the highest level of peer review. Peer review was sought at key stages during the process of identifying data sources, designing surveys for further data collection, data analysis and interpretation, and the final evidence based advice.

Principle 3: Communication and publication of data and methods
The evidence used to identify possible SPAs is available through a series of published reports and other background material. Key publications on the identification of possible SPAs have been listed in the supplementary document: Principles guiding the use of evidence in the identification of possible SPAs in Scotland.

In summary, JNCC's marine SPA advice is quality assured, making extensive use of external independent peer review.

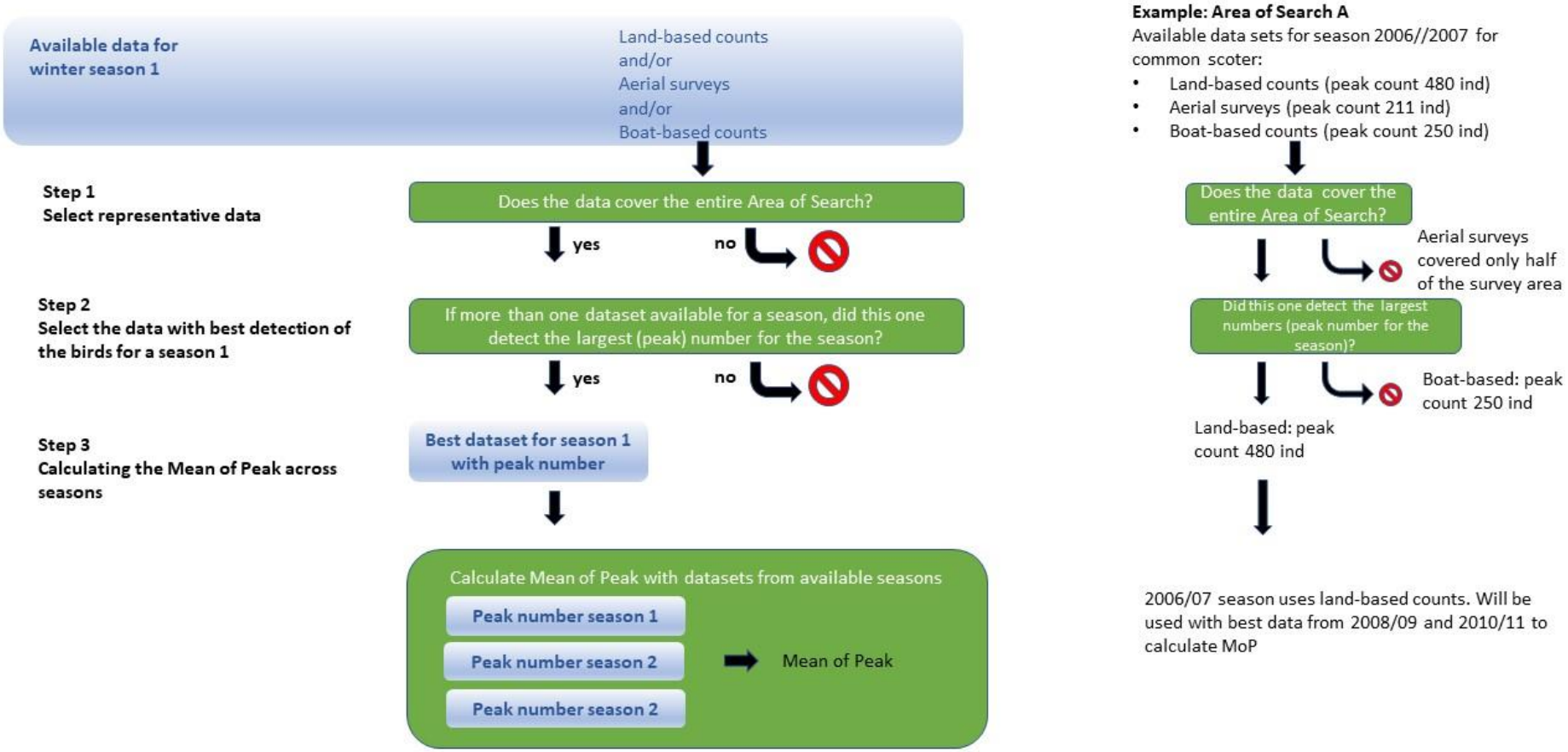


Figure 1: JNCC selection of best available data for inshore wintering waterfowl where often more than one data source exists

6 Process of marine SPA selection process in Scotland

Once the data collection is complete, analysis commences to identify from all the different types of marine work which areas are suitable for proposing as an SPA. All potential areas are assessed against the UK SPA Selection Guidelines (JNCC, 1999).

The UK SPA Selection Guidelines set out a two stage process. Stage 1 allows identification of all areas that meet one of four guidelines and could be proposed for SPA status. Stage 2 looks at all areas identified by Stage 1 and selects the most suitable for becoming SPAs (section 6.1). How suitable an area is depends on several ecological judgements listed under Stage 2 of the guidelines e.g. size of population areas, number of different species supported. The guidelines do not require all areas meeting Stage 1 to be taken forward to site selection and classification. An overview of the process is provided in Figure *2* with further detail on each area of marine work provided in section 7.

In Scotland, the selection of proposed SPAs where these fall largely within 12 nautical miles from shore is the responsibility of SNH; in England the same responsibility falls to Natural England. For those areas where they fall largely beyond 12 nautical miles, the responsibility of site selection lies with JNCC. SNH, JNCC and Natural England have worked together to progress areas which are either cross-border or include both inshore and offshore waters. Natural England, Natural Resources Wales, and the Department of Environment Northern Ireland (DoENI) have classified several SPA proposals in English, Welsh and Northern Irish inshore waters respectively, including extensions to existing seabird colony SPAs and wholly marine SPAs.

The assessments of Stage 1 identification are for the most part applied consistently across the UK in the same way by all SNCBs. However, decisions on the application of Stage 2 guidelines lie with the relevant SNCB. This paper concentrates on how the guidelines were applied by SNH in inshore waters. A separate paper has been published by JNCC on how they applied Stage 2 guidelines to select the most suitable areas in offshore waters.

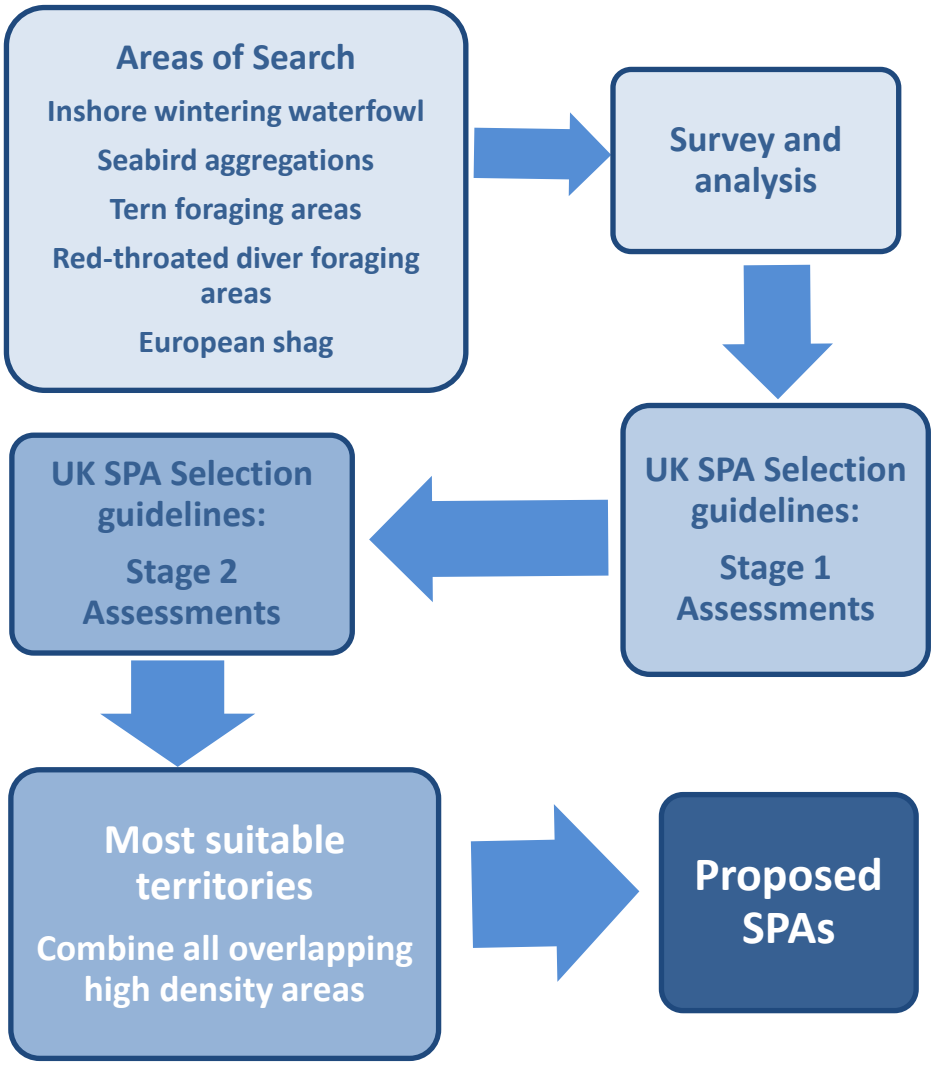


Figure 2: Overview of marine SPA selection process in Scotland

6.1 UK SPA Selection Guidelines

The UK SPA Selection Guidelines were established for terrestrial SPAs in 1999 (JNCC, 1999) and have been followed by all SNCBs in the selection of marine SPAs. The guidelines are as follows:

Stage 1

To qualify under Stage 1 the area needs to meet one or more of the following four guidelines:

1.1 An area is used regularly by 1% or more of the Great Britain (or in Northern Ireland, the all-Ireland) population of a species listed in Annex I of the Birds Directive (79/409/EEC as amended) in any season.

1.2 An area is used regularly by 1% or more of the biogeographical population of a regularly occurring migratory species (other than those listed in Annex I) in any season.

1.3 An area is used regularly by over 20,000 waterfowl (waterfowl as defined by the Ramsar Convention) or 20,000 seabirds in any season.

1.4 An area which meets the requirements of one or more of the Stage 2 guidelines in any season, where the application of Stage 1 guidelines 1.1-1.3 for a species does not identify an adequate network of most suitable areas for the conservation of that species.

Stage 2

To identify the most suitable areas, one or more of the ecological judgements set out in Stage 2 are considered. The Stage 2 judgements are:

2.1 Population size and density
Areas holding or supporting more birds than others and/or holding or supporting birds at higher concentrations are favoured for selection.

2.2 Species range
Areas selected for a given species provide as wide a geographic coverage across the species' range as possible.

2.3 Breeding success
Areas of higher breeding success than others are favoured for selection.

2.4 History of occupancy
Areas known to have a longer history of occupation or use by the relevant species are favoured for selection.

2.5 Multi-species area
Areas holding or supporting the larger number of qualifying species under Article 4 of the Directive are favoured for selection.

2.6 Naturalness[9]
Areas comprising natural or semi-natural habitats are favoured for selection over those which do not.

2.7 Severe weather refuges
Areas used at least once a decade by significant proportions of the biogeographical population of a species in periods of severe weather in any season, and which are vital to the survival of a viable population, are favoured for selection.

6.2 Definition of 'regularly'

To meet Stage 1.1, 1.2 or 1.3 of the guidelines the area needs to be used 'regularly'. To define 'regularly', the SPA guidelines have adopted the definition of regularity used by 'The Conference of the Contracting Parties to the Ramsar Convention' (JNCC, 1999). Ramsar site selection criteria define regular occurrence as:

[9] Naturalness was not considered in the marine context as it effectively allowed no discrimination between marine areas of search.

- the requisite number of birds is known to have occurred in two thirds of the seasons for which adequate data are available, the total number of seasons being not less than three [definition 1]; or
- the mean of the maxima of those seasons in which the site is internationally important, taken over at least five years, amounts to the required level [definition 2].

See examples provided below:

Definition 1
Three years of data are available for non-breeding red-throated diver at an Area of Search:

Year	**Peak Count* of the season (individuals)**
2001	230
2002	245
2003	165

The required population threshold for non-breeding red-throated diver is 1% of the GB population (170 individuals). The counts exceed 170 individuals on two of the three years (two thirds) that data is available and therefore, meets the first definition of regularity.

Definition 2
Five years of data are available for non-breeding red-throated diver at an Area of Search:

Year	**Peak count* of the season (individuals)**
2001	230
2002	101
2003	165
2004	311
2005	140
Mean:	**189.4**

The mean of the peak counts is 189.4 individuals which exceeds 170 individuals and therefore, meets the second definition of regularity.

* Where there are multiple counts in one season, the highest count (peak count) is used.

6.3 Assemblages

To meet the Stage 1.3 guideline, an area must support at least 20,000 seabirds or waterbirds[10] comprised of two or more main component species on a regular basis and within the relevant season (breeding or non-breeding).

An assemblage identified under Stage 1.3 comprises the total number of *all* species (migratory and Annex I) present within the area and can include (but is not dependent on) species also qualifying under Stage 1.1 and 1.2. It is only those species where the numbers of individuals are equal to or exceed 1% of the GB population or 2,000 (10% of 20,000)

[10] "Waterbirds" includes waders as well as wildfowl species

individuals (Stroud et al., 2001) which are considered the main component species that characterise the assemblage. In Scotland, these species are identified as 'named qualifiers' of the assemblage. For example, see Areas 1 and 2 below:

Example Areas 1 and 2:

Area 1: Supports 18,000 breeding common guillemot, 2,500 northern fulmar, 1,500 Arctic tern and 1000 black-legged kittiwake and qualifies as a breeding seabird assemblage.

Area 2: Supports 28,000 breeding common guillemot (comprising only 0.8% of the biogeographic population), 250 black-legged kittiwake and 950 northern fulmar but does not qualify as a breeding seabird assemblage.

In the examples both areas support more than 20,000 individuals. For Area 1 common guillemot, northern fulmar and Arctic tern would be identified as named qualifiers of the assemblage but black-legged kittiwake would not. However, black-legged kittiwake numbers would still contribute towards the overall assemblage estimate. In Area 2, only one species (common guillemot) exceeds the required thresholds to be identified as a named qualifier and therefore, an assemblage has not been identified.

For an assemblage, the test for regularity is also based on three years of data for two or more of the main component species rather than the assemblage as a whole i.e. it is inferred that the assemblage is regularly present with >20,000 individuals made up of two or more species provided collectively some or all of these species exceed the 20,000 population threshold in two of the three years.

In the terrestrial environment (including seabird colony SPAs), species' spatial distributions within an area meeting the requirements for Stage 1.3 generally have a significant overlap of the named qualifiers forming the assemblage. In most cases, the assemblage area reflects the combined distributions of its named qualifiers and this ultimately forms the basis for defining the SPA boundary. In some cases, however, the boundary can be influenced by a single species, which may be one of the named qualifiers of the assemblage but also qualifies in its own right under Stage 1.1 or 1.2.

6.4 Minimum threshold of 50 individuals

It is established practice in the UK to only include waterbirds as a qualifying feature of a site where their population meets a minimum threshold of 50 individuals on a regular basis (Stroud *et al.,* 2001, UK SPA Scientific working group, 2002). This is irrespective of whether 50 individuals exceed the population thresholds required to meet Stage 1.1 of the UK SPA Selection guidelines.

The objective of applying a minimum threshold of 50 is to act as a filter to avoid the identification as qualifying species at sites holding very small numbers of birds, where such selection would make no significant contribution to the conservation needs of those species.

The UK SPA and Ramsar Scientific Working Group further reviewed this practice in 2001. The conclusion was that "The Group agreed to uphold the 'minimum of 50' rule, but recognised that there may be a few exceptions where sites supporting low numbers of non-breeding birds would add to the conservation of a given species, especially in contributing to range maintenance. Such cases will be reviewed and agreed when necessary" (Stroud et al., 2001).

In 2015, the Scientific Working Group identified Slavonian grebe as an exception to the minimum of 50 individuals in the marine environment. 50 individuals are approximately 5% of the GB Slavonian grebe non-breeding population. The working group concluded that the application of the minimum of 50 individuals rule to would preclude the selection of suitable territories for this species and therefore prevent the fulfilment of UK obligations under the Birds Directive (UK SPA Scientific working group, 2015).

7 Selection of specific marine SPAs in Scotland

7.1 Inshore wintering waterfowl

Scottish inshore waters (within 12 nautical miles of the coast) are well known strongholds of non-breeding sea duck, divers and grebes. The breeding grounds of many of these species can be as far afield as Arctic Canada or Siberia where they nest at low densities over extensive areas. During the winter months however these species regularly occur, often in large numbers, in predictable inshore areas such as sounds, bays and estuaries. These areas are used for feeding and moulting, and/or as staging posts where waterfowl gather to overwinter. For species that aggregate either forming large flocks (e.g. long-tailed duck, eider) or loose aggregations (e.g. divers) marine SPAs can play an important role in protecting the marine habitats and prey these birds rely on, as well as increasing their resilience to wider-scale impacts (see Annex 1).

The UK has a significant international responsibility for high proportions (Stroud et al., 2001) of some waterfowl species, with Scotland in many cases supporting most of the UK wintering population of these species.

7.1.1 Areas of Search

When the work to identify potential areas for marine SPAs started there were few data available on the distribution of non-breeding waterfowl around the UK coast. Data were also predominantly limited to shore counts that do not capture the full seaward extent of sea duck and diver distributions.

Existing data (including Wetland Bird Surveys, Important Bird Areas under BirdLife International, existing survey data and an atlas of seabird distributions) and information from published scientific literature were used to identify initial areas that might support non-breeding aggregations of waterfowl.

Based on this initial step, 46 Areas of Search were identified across the UK (Figure 3). These areas were assessed and prioritised for further data collection, collation and analysis. Of these, twenty-one[11] Areas of Search that could potentially contain qualifying aggregations of wintering waterfowl (divers, grebes and sea duck) were identified in Scottish coastal waters. These Areas of Search formed the focus of JNCC survey and analysis and subsequent consideration against the UK SPA Selection Guidelines by SNH.

The species addressed as part of the inshore wintering waterfowl survey and analysis programme included four Annex 1 species (non-breeding great northern diver, red-throated diver, black-throated diver and Slavonian grebe), 10[12] migratory waterfowl species (see

[11] There were originally 22 Areas of Search but the Greater Firth of Clyde and Inner Firth of Clyde, lying adjacent to each other were combined by JNCC to form the Firth of Clyde Area of Search.
[12] Note: Lawson et al., 2015 (Table 1) included red-necked grebe and confirmed very low numbers in Scottish waters.

Table 1) and three non-breeding seabirds (little gull (Annex 1 species) and shag and cormorant).

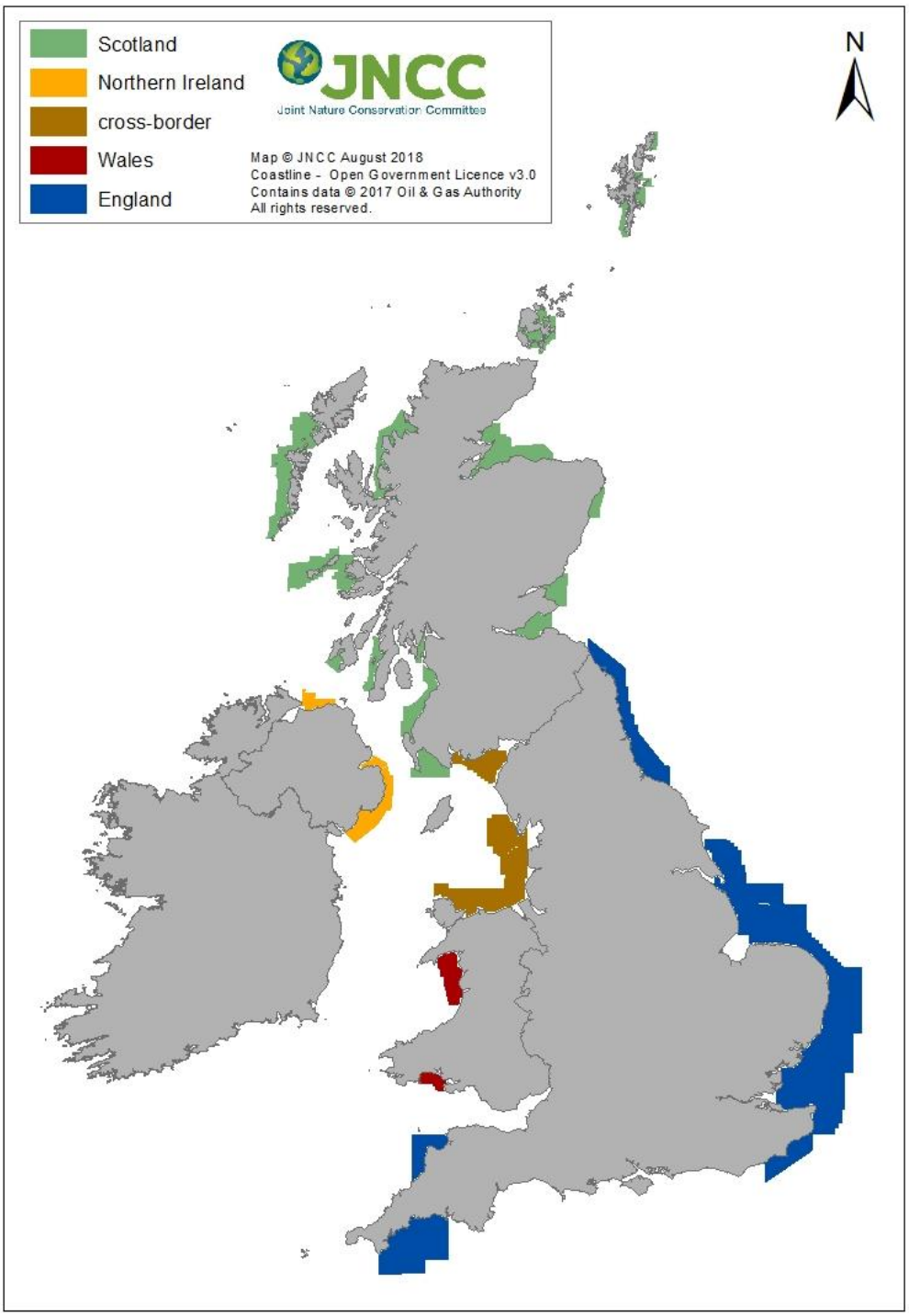
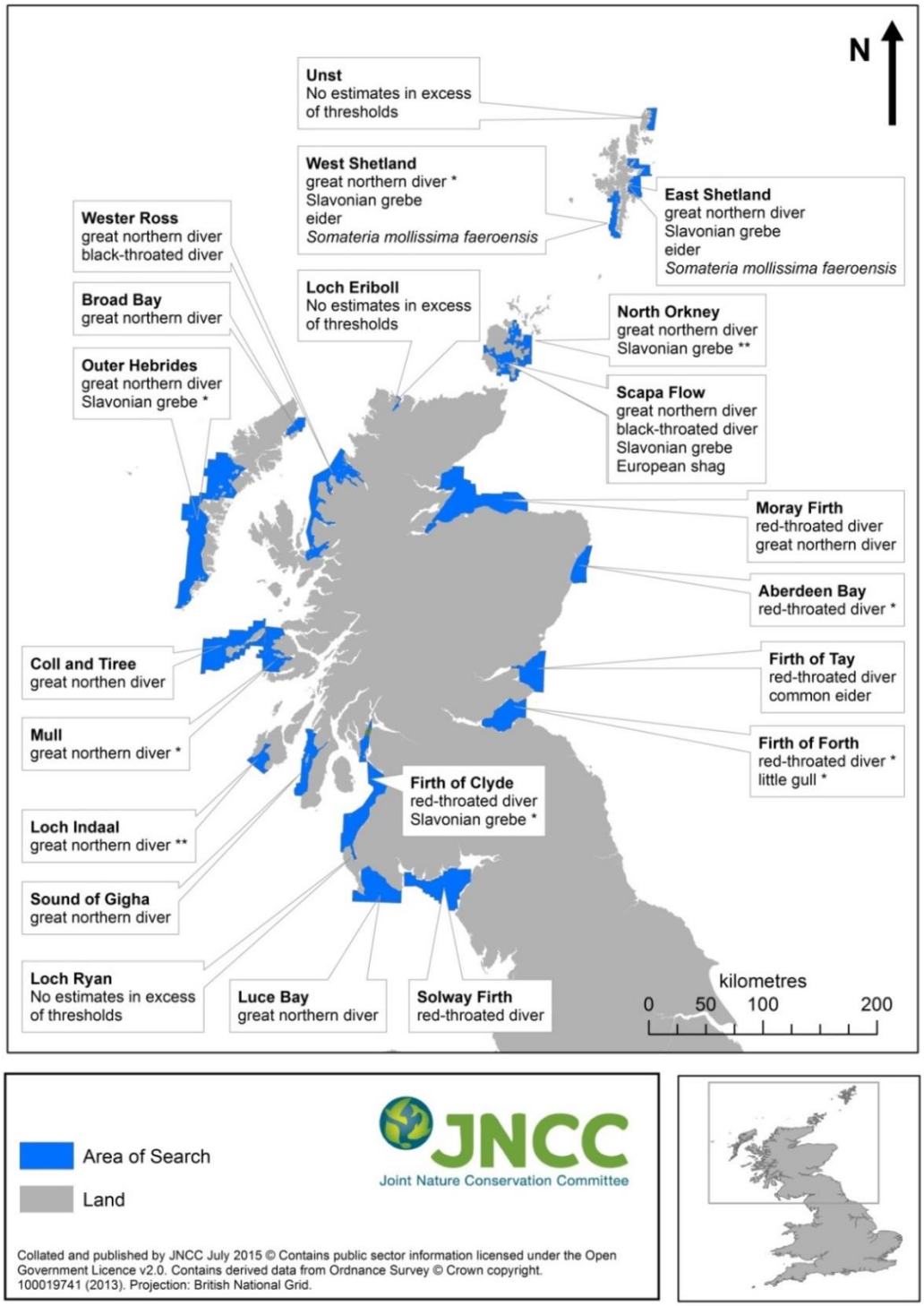


Figure 3: Areas of Search for inshore wintering waterfowl throughout the UK.

7.1.2 Site selection of important areas inshore wintering waterfowl

The JNCC analysis of the 21 Scottish Areas of Search first identified which of the Areas of Search supported numbers of diver, grebe, shag and/or sea duck meeting the population thresholds required under Stage 1.1 or 1.2 guidelines. Further analysis was made on the

regularity (section 6.2) with which the requisite numbers of birds occurred within each Area of Search. The results of this analysis are shown in Figure 4.



* Species with more than 3 years of data but do not meet the guideline for regularity.
** Species with less than 3 years of data - the minimum required to establish regularity.

Figure 4: Areas of search and species meeting the relevant population thresholds under Stage 1.1 or Stage 1.2

Full details of the scientific evidence and all analyses conducted for the individual Areas of Search are provided in the JNCC Report 567 (Lawson et al., 2015) and the non-technical summary: Identification of important marine areas for inshore wintering waterbirds.

SNH used the results of the JNCC population and regularity analysis to assess the 21 Areas of Search against the UK SPA Selection guidelines. Figure 5 provides an overview of the process of site selection carried out for inshore wintering waterfowl in Scotland by SNH.

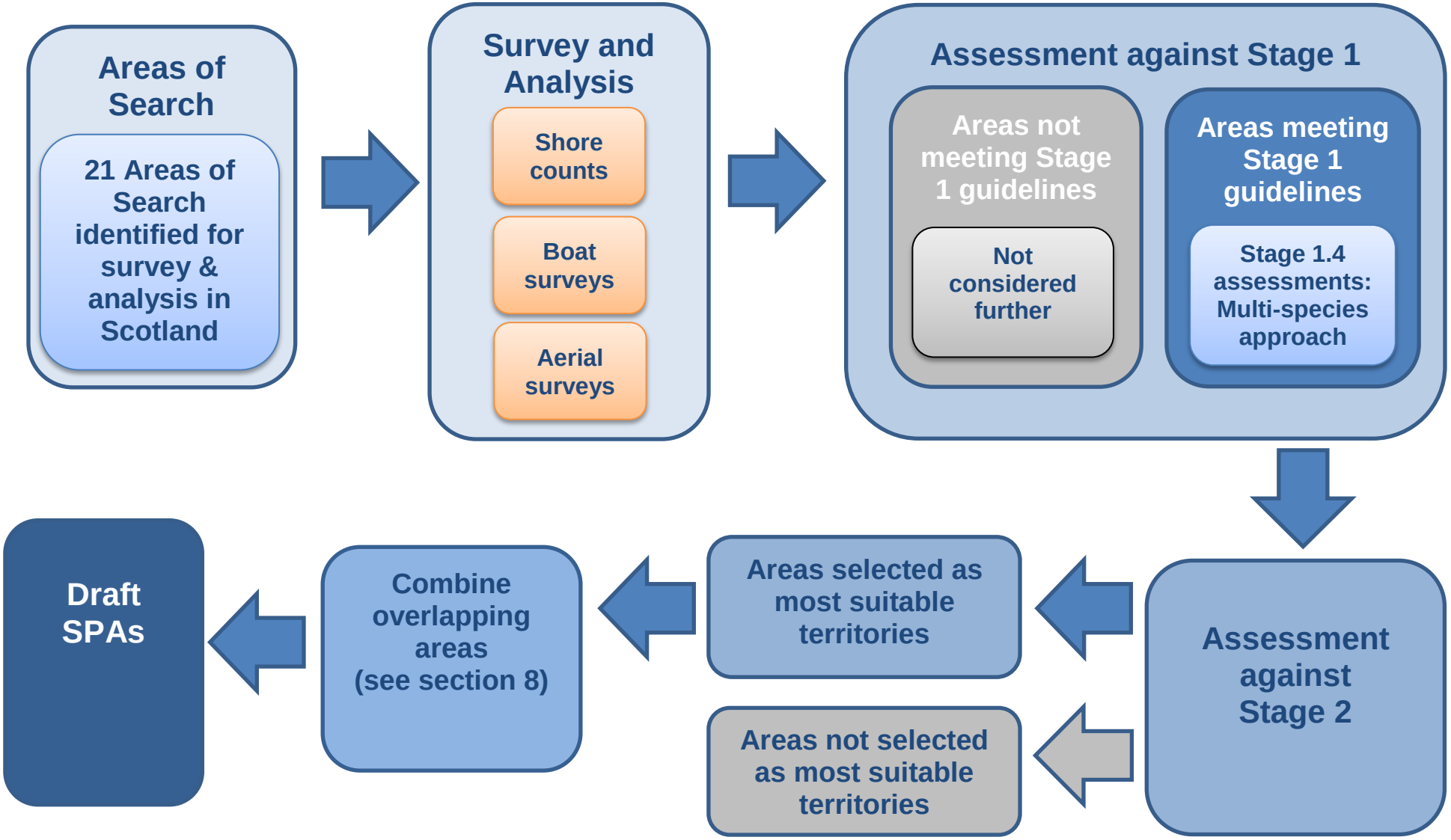


Figure 5: Overview of the site selection process for inshore wintering waterfowl (including little gull and shag)

7.1.3 Stage 1.1-1.3 assessment of the 21 Areas of Search

Of the 21 Areas of Search analysed by JNCC, three Areas of Search (Unst, Loch Eriboll and Loch Ryan) did not meet any of the population thresholds required under Stage 1 and therefore were not considered further. Loch Indaal, Aberdeen Bay and Mull were also rejected at this stage of the assessment because despite a single Annex 1 species being present at each Area of Search in numbers meeting the population thresholds, they did not occur regularly and therefore none of the bird species in these Areas of Search fully meet the Stage 1 guidelines.

The remaining fifteen[13] Areas of Search (Table 3) fully met the requirements of Stage 1.1 or 1.2 for one or more species. None however held 20,000 or more individuals and therefore no Areas of Search met Stage 1.3.

To ensure all Annex 1 species were fully represented in the SPA network, all Annex 1 species that met the required population thresholds continued to be considered as potential qualifying species, irrespective of whether they met the guidelines for regularity. This included Slavonian grebe at North Orkney and red-throated diver at Firth of Forth.

Table 3: Areas of Search for inshore wintering waterfowl meeting Stage 1.1 and Stage 1.2 guidelines

Area of search	Annex 1 species qualifying under Stage 1.1	Migratory species qualifying under Stage 1.2	Total number of individuals[14]
West Shetland	Great northern diver Slavonian grebe	Common eider *faeroensis*	2,712
East Shetland	Great northern diver Slavonian grebe	Common eider *faeroensis*	1,873
North Orkney	Great northern diver Slavonian grebe*	none	5,346
Scapa Flow	Great northern diver Black-throated diver Slavonian grebe	European shag[15]	8,089
Moray Firth	Great northern diver Red-throated diver	none	16,614
Firth of Tay	Red-throated diver	Common eider	16,411
Firth of Forth	Red-throated diver* Slavonian grebe	Little gull[16]	15,099
Wester Ross	Great northern diver Black-throated diver	none	1,268
Broad bay	Great northern diver	none	1,779
Outer Hebrides	Great northern diver	none	8,166
Coll and Tiree	Great northern diver	none	2,147
Sound of Gigha	Great northern diver	none	2,276

[13] Firth of Forth and Firth of Tay were subsequently combined (see section 8.1) to form the Outer Firth of Forth and St Andrews Bay Complex pSPA
[14] For assessment against Stage 1.3 guideline
[15] Shag (seabird species) was identified in qualifying numbers at Scapa Flow during the inshore wintering waterfowl surveys.
[16] Little gull (seabird species) was identified in qualifying numbers (more than 50 individuals) at Firth of Forth during the inshore wintering waterfowl surveys.
* Not regularly occurring.

Area of search	Annex 1 species qualifying under Stage 1.1	Migratory species qualifying under Stage 1.2	Total number of individuals[14]
Firth of Clyde	Red-throated diver Slavonian grebe	none	4,362
Luce bay	Great northern diver	none	1,638
Solway	Red-throated diver	none	2,618
Aberdeen Bay	none	none	1,515
Loch Indaal,	none	none	1,464
Mull	none	none	340
Loch Eriboll	none	none	229
Loch Ryan	none	none	2,362
Unst,	none	none	76

7.1.4 Addition of waterfowl migratory species under Stage 1.4

The initial assessment against the Stage 1 guidelines highlighted that of the 18 waterfowl species recorded during the inshore wintering waterfowl survey work in Scotland (Table 1), ten migratory species (common eider (two sub-species), long-tailed duck, common scoter, velvet scoter, common goldeneye, greater scaup, great-crested grebe[17], red-breasted merganser and goosander) did not meet the required population thresholds under Stage 1.2 in any of the Areas of Search. Therefore, despite the UK (largely Scotland) supporting relatively large aggregations of these species they would fail to be represented in a network of marine SPAs.

As discussed in sections 3 and 4, site-based protection in the UK is considered an effective conservation measure for these ten species, particularly where the Area of Search supports multiple species in relatively high numbers. Further consideration of migratory species not qualifying under Stage 1.2 was therefore made by SNH in discussion with JNCC and Marine Scotland under Stage 1.4.

Stage 1.4 gives some latitude for addressing species where Stages 1.1, 1.2 or 1.3 do not identify an adequate network of most suitable areas for the conservation of that species. Generally, this is through the addition of species as a qualifying feature to potential areas already meeting the Stage 1 guidelines for one or more species, and providing one or more of the Stage 2 guidelines in any season are met.

Stage 1.4 has been used to such effect to select SPAs in the terrestrial environment (in whole or part) for greater scaup and breeding common scoter.

As recognised by the SPA Review 2001 (Stroud et al., 2001), the UK holds significant populations of wintering waterfowl, often occurring in large aggregations, regularly in predictable locations. Scottish inshore waters support a large proportion of the UK population of many of these species and therefore, Scotland has a particular responsibility for their protection.

Many inshore locations support both Annex 1 and migratory species in significant numbers and represent a diverse assemblage of five or more waterfowl species. SNH's focus in developing this advice was to capture areas with a multi-species interest, making an enhanced contribution to a network of marine protected areas.

[17] Great-crested grebe did not meet the requirements for qualifying under Stage 1.4 guideline.

Decisions on whether to include additional migratory species as qualifying features in the 15 Areas of Search therefore focused on a combination of the Stage 1.4 and Stage 2.5 (multi-species area) guidelines (UK SPA Selection Guidelines).

The multi-species approach developed by SNH, in agreement with JNCC applied the following principles:

- Species can only become candidates for inclusion in a potential SPA where the area is used regularly by 1% or more of the GB population.
- Migratory species can only be added to potential SPAs that have already been identified for one or more species using Stage 1.1 or Stage 1.2.
- The inclusion of these species makes little or no difference to the proposed boundary (as defined by species qualifying under Stage 1.1 or Stage 1.2) of the potential SPA.

As the emphasis was on selecting areas with a multi-species interest, no judgements were made on:

- The relative percentage of the biogeographic population represented at each Area of Search by species exceeding 1% of the GB population.
- The number of sites required for each species.

The multi-species approach provides an objective and consistent approach to the application of Stage 1.4 and is supported by SNH's Scientific Advisory Committee.

The population threshold of 1% or more of the GB population was selected because it is consistent with the population threshold used to identify named qualifiers of waterbird assemblages (section 6.3). Species such as common goldeneye and greater scaup are included in waterbird assemblages in the existing terrestrial SPA network on the basis of these areas regularly supporting 1% or more of their GB population. At these existing SPAs, the population threshold of more than 20,000 individuals is largely influenced by the high numbers of non-breeding waders or geese rather than sea duck and/or grebe.

The 15 Areas of Search meeting the Stage 1.1 or Stage 1.2 guidelines were analysed to establish if they supported 1% or more of the GB population of any additional migratory species. The results of this analysis are provided in Table 4.

Table 4: Areas of Search for inshore wintering waterfowl meeting the qualifying population thresholds for Stages 1.1, 1.2 and 1.4 guidelines

Area of search	**Species meeting the qualifying population thresholds for stages 1.1 or 1.2**	**Migratory species qualifying under Stage 1.4 using the multi-species approach population threshold**
West Shetland	Great northern diver Slavonian grebe Common eider *faeroeensis*	Long-tailed duck Red-breasted merganser
East Shetland	Great northern diver Slavonian grebe Common eider *faeroeensis*	Long-tailed duck Red-breasted merganser
North Orkney	Great northern diver Slavonian grebe	Common eider Long-tailed duck Velvet scoter Red-breasted merganser European shag
Scapa Flow	Great northern diver Black-throated diver	Common eider Long-tailed duck

Area of search	Species meeting the qualifying population thresholds for stages 1.1 or 1.2	Migratory species qualifying under Stage 1.4 using the multi-species approach population threshold
	Slavonian grebe European shag	Common goldeneye Red-breasted merganser
Moray Firth	Great northern diver Red-throated diver	Greater scaup Common eider Long-tailed duck Velvet scoter Common scoter Common goldeneye Red-breasted merganser
Firth of Tay	Red-throated diver Common eider	Long-tailed duck Velvet scoter Common scoter Red-breasted merganser
Firth of Forth	Red-throated diver Slavonian grebe Little gull	Common eider Long-tailed duck Velvet scoter Common scoter Common goldeneye Red-breasted merganser
Wester Ross	Great northern diver Black-throated diver	Red-breasted merganser
Broad bay	Great northern diver	Common eider Long-tailed duck
Outer Hebrides	Great northern diver	Common eider Long-tailed duck Red-breasted merganser
Coll and Tiree	Great northern diver	Common eider
Sound of Gigha	Great northern diver Slavonian grebe[5]	Common eider Red-breasted merganser
Firth of Clyde	Red-throated diver Slavonian grebe	Common eider Common goldeneye Red-breasted merganser
Luce bay	Great northern diver	none
Solway	Red-throated diver	Greater scaup Common scoter

7.1.5 Stage 2 assessment of inshore wintering waterfowl species

The UK SPA Selection Guidelines enable the most suitable territories in the UK to be selected as SPAs. To identify the most suitable territories from the Areas of Search meeting Stage 1, the selection guidelines require one or more of the ecological judgements set out in Stage 2 to apply.

As mentioned in section 7.1.4, capturing areas comprising multiple species was a key factor in identifying the most suitable territories for inshore wintering waterfowl. The conservation and ecological value of a UK SPA network is also strengthened if potential sites are selected where they hold some of the largest populations of these species and represent the full geographical extent of a species range.

To determine which Areas of Search should be selected as the most suitable territories, SNH carried out a four-step process:

Step 1: *Population size, density and multi-species areas of Annex 1 species*

The Stage 2.1 guideline (population size and density) favours the selection of areas supporting more birds than others and/or supporting birds of higher concentration. Similarly, the Stage 2.5 guideline (multi-species area) favours selection of areas supporting the larger number of qualifying species (under Stages 1.1, 1.2 and 1.4).

SNH used a ranking approach to objectively determine the relative importance of each Area of Search to each Annex 1 species (great northern diver, red-throated diver, black-throated diver and Slavonian grebe) according to population size, density and the number of qualifying species they shared an Area of Search with. The analysis applied weightings of 25% for population size, 25% for density and 50% for multi-species to favour areas that had the highest species interest and therefore could potentially make an enhanced contribution to the SPA network.

The results of this analysis are provided in Table 5 with one being the highest ranked (based on population, density and multi-species interest) Area of Search for each Annex 1 species.

The multi-species approach was reviewed and approved by SNH's Scientific Advisory Committee.

Step 2: *Geographic range of Annex 1 species*

Stage 2.2 guideline (geographic range) requires areas selected for species to *'provide as wide a geographic coverage across the species range as possible'*. The degree of replication around Scotland to provide as wide a geographic coverage as possible is considered by SNH in the context of the individual species distribution in Scotland.

The Stage 2 assessments of geographic range for the Annex 1 species are provided in Table 5. Areas of Search ranked 1 for each Annex 1 species and representing the core or edge of range of each species distribution in Scotland presented the strongest candidates for selection as the most suitable territories. An indicative network of eight most suitable territories was initially selected based on the relative importance of the Stage 2 assessments for the Annex 1 species:

- Firth of Forth
- Firth of Tay
- Moray Firth
- Scapa Flow
- North Orkney
- Outer Hebrides
- Sound of Gigha
- Solway Firth

Step 3: *Confirmation of the draft network*

The indicative network was further reviewed to establish if all qualifying migratory species (under Stage 1.2) were included in the network identified so far and to ascertain whether the indicative network represented *"as wide a geographic coverage across the species range as possible"* (Stage 2.2).

Four Areas of Search were selected in Stage 1 (guideline 1.2) as possible areas for migratory species - Scapa Flow for European shag, Firth of Tay for common eider (sub-species *mollissima)* and East Shetland and West Shetland for common eider (sub-species *faeroeensis)*. Stage 2 assessments were carried out for Scapa Flow and Firth of Tay as these Areas of Search had already been identified in the indicative network. No ranking of relative importance was necessary as European shag and common eider (sub-species *mollissima)* were only represented in one Area of Search each.

The Stage 2 assessment of shag at Scapa Flow further strengthened the selection of Scapa Flow as a most suitable territory because in addition to the relative importance of the Area of Search for Annex 1 species it also supported the largest population of non-breeding shag in Scotland. The Stage 2 assessment of common eider (sub-species *mollissima)* at the Firth of Tay similarly strengthened the selection of the Firth of Tay as a most suitable territory in addition to the relative importance of the Area of Search for non-breeding red-throated diver.

Common eider (sub-species *faeroeensis)* were only represented in two Areas of Search. Both East Shetland and West Shetland were ranked relatively low for their respective Annex 1 species and only selected through the ranking process of Annex 1 species.

The indicative network was submitted to SNH's Scientific Advisory Committee (MPA sub-group) to review. The Committee advised that one of the Areas of Search for the migratory qualifying common eider (sub-species *faeroeensis)* should be included in the indicative network to fulfil our obligations under Article 4.2 of the Birds Directive. In addition, they also identified a gap in the core geographic range of great northern diver and advised that the Coll and Tiree Area of Search should be retained.

The decision on which Area of Search to include in the network for common eider (sub-species *faeroeensis)* was based on the relative importance of each for great northern diver. Scotland has sole responsibility for this species in the UK and Shetland is a key component of their non-breeding distribution, so the addition of an Area of Search that also included great northern diver as part of a multi-species site was considered to be of greater conservation benefit to the SPA network as a whole. Only the East Shetland Area of Search supported qualifying numbers of great northern diver. Therefore, East Shetland was added to the indicative network to ensure inclusion of qualifying common eider (sub-species *faeroeensis).*

Further review of the Coll and Tiree Area of Search highlighted that the area of search supported the fourth largest population of great northern diver. The reason for it being ranked relatively low for its Annex 1 species overall was because of its multispecies interest with only great northern diver and common eider occurring in qualifying numbers. Because of the geographic range gap and the high population estimate for great northern diver the Coll and Tiree Area of Search was included in final iteration of the indicative SPA network.

At this stage in the selection process West Shetland, Firth of Clyde, Wester Ross, Broad Bay and Luce Bay were rejected because, although identified as areas to be considered under Stage 1, under Stage 2 they were not considered to be most suitable for any of the Annex 1 species, or for the migratory species which had possible areas selected under Stage 1 (see additional comments in Table 5).

Table 5: Stage 2 assessment of Annex 1 inshore wintering waterfowl species.

Population size and density (Stage 2.1) [18] and multi-species area (Stage 2.5) guidelines were ranked and then combined to provide an overall rank for each species.
NQ – species not qualifying under Stage 1, N/A* - species excluded from analysis as population estimate was less than 50 individuals[19]
Areas of Search selected for inshore wintering waterfowl are highlighted blue.

Area of Search	**Great northern diver - Overall rank**	**Red-throated diver – Overall rank**	**Black-throated diver – Overall rank**	**Slavonian grebe – Overall rank**	**Migratory species identified by inshore wintering waterfowl analysis (all species meeting 1% GB)**	**Number of qualifying species (stages 1.1, 1.2 & 1.4) in Area of Search**	**Range (Scotland)**	**Judgments influencing site proposal**
West Shetland	N/A*	NQ	NQ	5	Eider, long-tailed duck and red-breasted merganser.	Total = 4	Slavonian grebe: One of three sites in the northeast of their range	Overall lowest ranked multi-species site for Slavonian grebe and therefore not considered to be a most suitable territory in the northeast of Scotland.
East Shetland	7	NQ	NQ	N/A*	Eider, long-tailed duck and red-breasted merganser	Total = 4	Great northern diver: Most northern site in GB - one of four sites in the northeast of their range.	Most northern site for great northern diver in Scotland/GB. One of two sites with qualifying numbers of eider *(faeroeensi)* meeting the Stage 1.2 population threshold and therefore **considered a most suitable territory for eider *(faeroeensi).***
North Orkney	3	NQ	NQ	2	Long-tailed duck, eider, velvet scoter, red-breasted merganser and shag[21].	Total = 7	Great northern diver: One of four sites in the northeast of their range. Slavonian grebe: One of three sites in the northeast of their range.	Highest ranked multi-species site for great northern diver in northeast of their range therefore **considered a most suitable territory for great northern diver in northeast of Scotland.** 2nd highest ranked multi-species site for Slavonian grebe in northeast of Scotland.
Scapa Flow	4	NQ	1	1	Long-tailed duck, eider, goldeneye and red-breasted merganser and shag[21]	Total = 8	Black-throated diver: Most northern site in GB, only site in northeast of their range. Great northern diver: One of four sites in the northeast of their range. Slavonian grebe: One of three sites in the northeast of their range.	Overall highest overall ranked multi-species site for black-throated diver and Slavonian grebe. Most important multi-species site for these species in northeast of Scotland. Therefore **considered a most suitable territory for black-throated diver and Slavonian grebe diver in northeast of Scotland.** 2nd highest ranked multi-species site for great northern diver in northeast of Scotland. Only site with qualifying numbers of European shag meeting the Stage 1.2 population threshold and **considered a most suitable territory for shag.**
Moray Firth	6	3	NQ	N/A*	Long-tailed duck, scaup, eider, common scoter, velvet scoter, goldeneye and red-breasted merganser.	Total = 9	Red-throated diver: Only site in northeast of their range - most northern site in GB. Great northern diver: One of four sites in the northeast of their range – most south-eastern site in GB.	3rd highest ranked multi-species site for red-throated diver and only site in north of their range. **Therefore considered a most suitable territory for red-throated diver in northeast of Scotland.** Most southern site for great northern diver in east of Scotland/GB. **Therefore considered a most suitable territory for great northern diver in southeast of their range in**

[18] The population estimates and densities used for the ranking exercise were provided by JNCC (O'Brien et al, 2010 and O'Brien et al. 2011, unpublished JNCC reports).
[19] Ranking exercise pre-dated the exemption of Slavonian grebe from the minimum of 50 individuals rule (UK SPA Scientific Working Group)

Area of Search	Great northern diver - Overall rank	Red-throated diver – Overall rank	Black-throated diver – Overall rank	Slavonian grebe – Overall rank	Migratory species identified by inshore wintering waterfowl analysis (all species meeting 1% GB)	Number of qualifying species (stages 1.1, 1.2 & 1.4) in Area of Search	Range (Scotland)	Judgments influencing site proposal
								Scotland.
Firth of Tay	N/A	1	NQ	NQ	Long-tailed duck, eider, common scoter, velvet scoter and red-breasted merganser	Total = 6	Red-throated diver: One of two sites in southeast of their range.	Overall highest ranked multi-species site for red-throated diver. Most important multi-species site for this species in southeast of Scotland. **Therefore considered a most suitable territory for red-throated diver in southeast of Scotland.** Most northern site in GB.
Firth of Forth	N/A	2	NQ	2	Little gull[20], long-tailed duck, eider, common scoter, velvet scoter, goldeneye and red-breasted merganser.	Total = 9	Red-throated diver: One of two sites in southeast of their range. Only site for Slavonian grebe in southeast of their range.	Joint 2nd highest ranked multi-species site for Slavonian grebe in Scotland. Most important multi-species site for this species in southeast of Scotland. **Therefore considered a most suitable territory for Slavonian grebe in southeast of Scotland.** 2nd highest ranked multi-species site for red-throated diver in southeast of Scotland.
Wester Ross	10	NQ	3	N/A*	Red-breasted merganser	Total = 3	Black-throated diver: One of two sites in the northwest of their range. Great northern diver: One of four sites in the northwest of their range.	Overall lowest ranked multi-species site for great northern diver and black-throated diver and therefore, not considered to be a most suitable territory in the northwest of Scotland.
Broad Bay	5	NQ	NQ	N/A*	Long-tailed duck and eider	Total = 3	Great northern diver: One of four sites in the northwest of their range.	Relatively low ranked multi-species site for great northern diver and no other qualifying Annex 1 species therefore, not considered to be a most suitable territory in the northwest of Scotland.
Outer Hebrides	1	NQ	2	4	Long-tailed duck, eider and red-breasted merganser	Total = 6	Black-throated diver: One of two sites in the northwest of their range. Great northern diver: One of four sites in the northwest of their range. Slavonian grebe: Only site in the west of their range.	Highest overall ranked multi-species site for great northern diver. Most important multi-species site for this species in northwest of Scotland. **Therefore considered a most suitable territory for great northern diver in northwest of Scotland.** Overall 2nd highest ranked site for black-throated diver. Most important multi-species site for this species in northwest of Scotland. **Therefore considered a most suitable territory for black-throated diver in northwest of Scotland.**
Coll & Tiree	8	NQ	NQ	NQ	Eider	Total = 2	Great northern diver: One of four sites in the northwest of their range.	Low ranked multi-species site for great northern diver and no other qualifying Annex 1 species. Gap established in core geographic range. **Therefore considered a most suitable territory for great northern diver in northwest of Scotland.**
Sound of Gigha	2	NQ	NQ	N/A*	Eider and red-breasted merganser.	Total = 3	Great northern diver: One of three sites in the southwest of their range.	Overall 2nd highest ranked multi-species site for great northern diver. Most important multi-species site for this species in southwest of Scotland. **Therefore considered a most suitable territory for**

[20] Qualifying numbers of little gull and shag were also identified from the inshore wintering waterfowl survey programme.

Area of Search	Great northern diver - Overall rank	Red-throated diver – Overall rank	Black-throated diver – Overall rank	Slavonian grebe – Overall rank	Migratory species identified by inshore wintering waterfowl analysis (all species meeting 1% GB)	Number of qualifying species (stages 1.1, 1.2 & 1.4) in Area of Search	Range (Scotland)	Judgments influencing site proposal
								great northern diver in southwest of Scotland.
Firth of Clyde	NQ	5	NQ	N/A*	Eider, goldeneye and red-breasted merganser.	Total = 4	Red-throated diver: One of two sites in the southwest of their range.	The population estimate for red-throated diver only just exceeded the Stage 1.1 threshold and was significantly lower than the Solway Firth population estimate. Overall, the Firth of Clyde was the lowest ranked multi-species site for red-throated diver and therefore, not considered to be one of the most suitable territories in Scotland.
Luce Bay	8	NQ	NQ	NQ	No other species	Total = 1	Great northern diver: One of three sites in the southwest of their range.	Single species site and therefore, not considered to be a most suitable territory in the southwest of Scotland.
Solway Firth	NQ	4	NQ	NQ	Scaup and common scoter	Total = 3	Red-throated diver: One of two sites in the southwest of their range.	Highest ranked multi-species site for red-throated diver in the southwest of their range. Most important site for this species in southwest of Scotland. **Therefore considered a most suitable territory for red-throated diver in southwest of Scotland.**

Step 4: *Population size and density and multi-species areas for regularly occurring migratory species qualifying under Stage 1.4*

The most suitable territories were essentially selected on the basis of the most suitable areas for species identified under Stage 1.1 and Stage 1.2. Stage 2 judgements were used to support inclusion of migratory species qualifying under Stage 1.4. No attempt was made to fill in gaps in distribution if the ten indicative sites resulting from steps 1, 2 and 3 did not represent the full geographic coverage of migratory species added in under Stage 1.4 in Scotland (for example, Firth of Clyde would represent the south easterly extent of the Scottish distribution of common eider, common goldeneye and red-breasted merganser). The key consideration was whether the Area of Search supported at least 1% of the GB population and therefore whether the species could be considered a characteristic component of a multi-species site. No indicative sites were identified solely on the basis of Stage 1.4 qualifiers.

The resulting ten indicative sites for inshore wintering waterfowl were presented to Marine Scotland in 2013. This included:

- Firth of Forth
- Firth of Tay
- Moray Firth
- Scapa Flow
- North Orkney
- Outer Hebrides
- Sound of Gigha
- Solway Firth
- East Shetland
- Coll and Tiree

7.1.6 Additional site specific decisions on Annex 1 species

<u>North Orkney</u>
Two years of good quality data (good of coverage and systematic shore-based surveys) were available for Slavonian grebe in North Orkney. Therefore, although present in sizeable numbers (second largest population in Scotland) they did not meet the strict guideline for regularly occurring.

However, counts of Slavonian grebe within small sections of the pSPA from several locations along the north shore between Wide Firth and Deer Sound are reported in the annual Orkney Bird Reports. In the four most recent winters for which data have been published (2009/10 to 2012/13) the maximum reported partial counts were 43, 46, 27 and 116 respectively. All of these are substantially in excess of the 1% GB population threshold (11 birds) and the exceptional count of 116 birds off Head of Holland in October 2012 is close to the peak mean of 120 birds for the two years when the whole site was systematically surveyed.

These additional data provide corroborative evidence that the area does regularly support high numbers of Slavonian grebe well in excess of 1% of the GB population. The conservation benefits of site protection for Slavonian grebe are outlined in Annex 1. The Slavonian grebe population at North Orkney represent a substantial proportion of the GB non-breeding population (11%) and therefore maintaining this population and its supporting habitats through site protection are likely to contribute to the survival and resilience of this species locally, nationally and in its wintering range in Europe. For this reason, and because

Slavonian grebe has no influence on the boundary of the site, Slavonian grebe has been proposed as a qualifying species of the North Orkney indicative site.

Velvet scoter and European shag both qualify under Stage 1.4 of the SPA Selection guidelines.

West coast of the Outer Hebrides
Black-throated diver well exceeded 1% of the GB population but just missed the minimum requirement of 50 individuals. Further consideration was given to this species in the Outer Hebrides because the survey methods highlighted a likely under-estimate and because only two Areas of Search held numbers exceeding the minimum requirement of 50 individuals despite black-throated diver being present in most areas.

The conservation benefits of site protection for black-throated diver are outlined in Annex 1. Black-throated diver in the Outer Hebrides represent a substantial proportion of the GB non-breeding population (7%) and therefore maintaining this population and its supporting habitats through site protection are likely to contribute to the survival and resilience of this species locally, nationally and in its wintering range in Europe. For this reason, and because black-throated diver has no influence on the boundary of the site, black-throated diver has been proposed as a qualifying species of the Outer Hebrides indicative site.

7.2 Seabird aggregations

The UK is of outstanding international importance for seabirds, hosting many different species and often in high population numbers. For example, more than 50% of the biogeographic populations of Manx shearwater, northern gannet and great skua and 30% of European shag and common guillemot breed in Great Britain (Mitchell et al., 2004). A significant proportion of the UK population of these species uses Scottish marine waters for foraging, resting, travelling and maintenance behaviours during the breeding season and during other times of the year.

Thirty-one extensions of SPAs into the marine environment have already been classified in Scottish inshore waters. These were established for a small number of species to protect areas used for maintenance behaviours (such as roosting and preening) close to the colonies. The marine maintenance extensions have a relatively restricted extent (1 km for auks, 2 km for fulmar and gannet and 4 km for Manx shearwater) that do not capture the more extensive foraging areas used by the SPA colony species. The marine SPA seabird aggregations programme specifically sought to identify locations used by large numbers of seabirds both in the breeding and non-breeding seasons and that were therefore likely to be represent important foraging areas.

Marine SPAs can play an important role in protecting the marine habitats and prey these birds rely on, as well as increasing their resilience to wider-scale impacts (see Annex 1). This is in addition to the protection already afforded many of the breeding seabirds from existing colony SPAs.

7.2.1 Areas of Search – approaches used for seabird aggregations

The main focus for identifying SPAs for seabird aggregations was the analysis of existing data from the European Seabird at Sea (ESAS database) (section 7.2.2). Additional approaches were also used for specific species where ESAS data was either considered not appropriate or not fully comprehensive (i.e. for species that are under-recorded by this survey method). The additional approaches are summarised below, with further detail provided in the relevant sections of this paper:

- Aerial surveys as part of the inshore wintering waterfowl survey programme (little gull and European shag) (section 7.1)
- Bespoke tracking and modelling of important foraging areas for terns (section 7.3)
- Bespoke tracking of important foraging areas for European shag (section 7.5)
- Winter Gull Roost Survey (section 7.6)

7.2.2 European Seabirds at Sea (ESAS) – qualifying areas

The ESAS database is the most comprehensive data set on distributions of seabirds in north-west European waters, holding more than two million records, collected over more than 30 years. The ESAS data dates back to the 1980s which makes them particularly useful for demonstrating the importance of an area over this extended time rather than relative short term importance.

The seabird species addressed as part of the ESAS analysis included 31 seabird species (Kober *et al.,* 2012), nine[21] Annex 1 species (Cory's shearwater, sooty shearwater, great shearwater[22], European storm-petrel, Leach's storm-petrel, little gull, Sandwich tern, common tern and Arctic tern) and 22[23] migratory seabirds species (see Table 1) including gulls, auks, skuas, shag, cormorant, fulmar and gannet.

Seabirds can aggregate anywhere in marine UK waters, particularly outside the breeding season when they do not need to return regularly to their nest. Due to the dispersed nature of seabird distributions, the Area of Search for seabirds as part of the ESAS analysis was the entire British Fishery Limit. Existing data from the ESAS database were analysed throughout the British Fishery Limit (which can reach to approximately 200 nautical miles off the coast) to identify areas where species were present in relatively high densities ('seabird hotpots'). Locations that display high and aggregated seabird densities were the focus for identifying the most suitable for SPAs. Species which are well dispersed, which occur in very low numbers or which do not exhibit spatially stable aggregations are not well-captured with this approach. In addition, small seabirds (such as terns) and those with a more coastal distribution (such as shag and cormorants) are also not readily captured by this approach. Therefore, there were a number of species for which areas that might be deemed suitable as SPAs could not be identified from the ESAS data (see sections 7.3 and 7.5).

To analyse the ESAS data, a three step process was applied:

Step 1: Seabird density maps were produced based on observations from the ESAS data.

Step 2: The highest and most aggregated bird densities ('seabird hotspots') were identified on these maps.

Step 3: These 'seabird hotspots'/areas were assessed against the raw data to see which ones had high densities on a regular basis.

Twenty-eight seabird areas were identified as regularly occurring in Scottish inshore and offshore waters (Figure 6). Full details of the analysis can be found in JNCC reports 431 and 461 (Kober et al., 2010 and Kober et al., 2012) and the non-technical summary.

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[21] Balearic shearwater, roseate tern and little tern were excluded as adequate data was not available.
[22] Included great shearwater which is not one of the list of 44 species regularly occurring in UK waters.
[23] Included pomarine skua and long-tailed skua which are not included in the list of 44 species regularly occurring in UK waters.

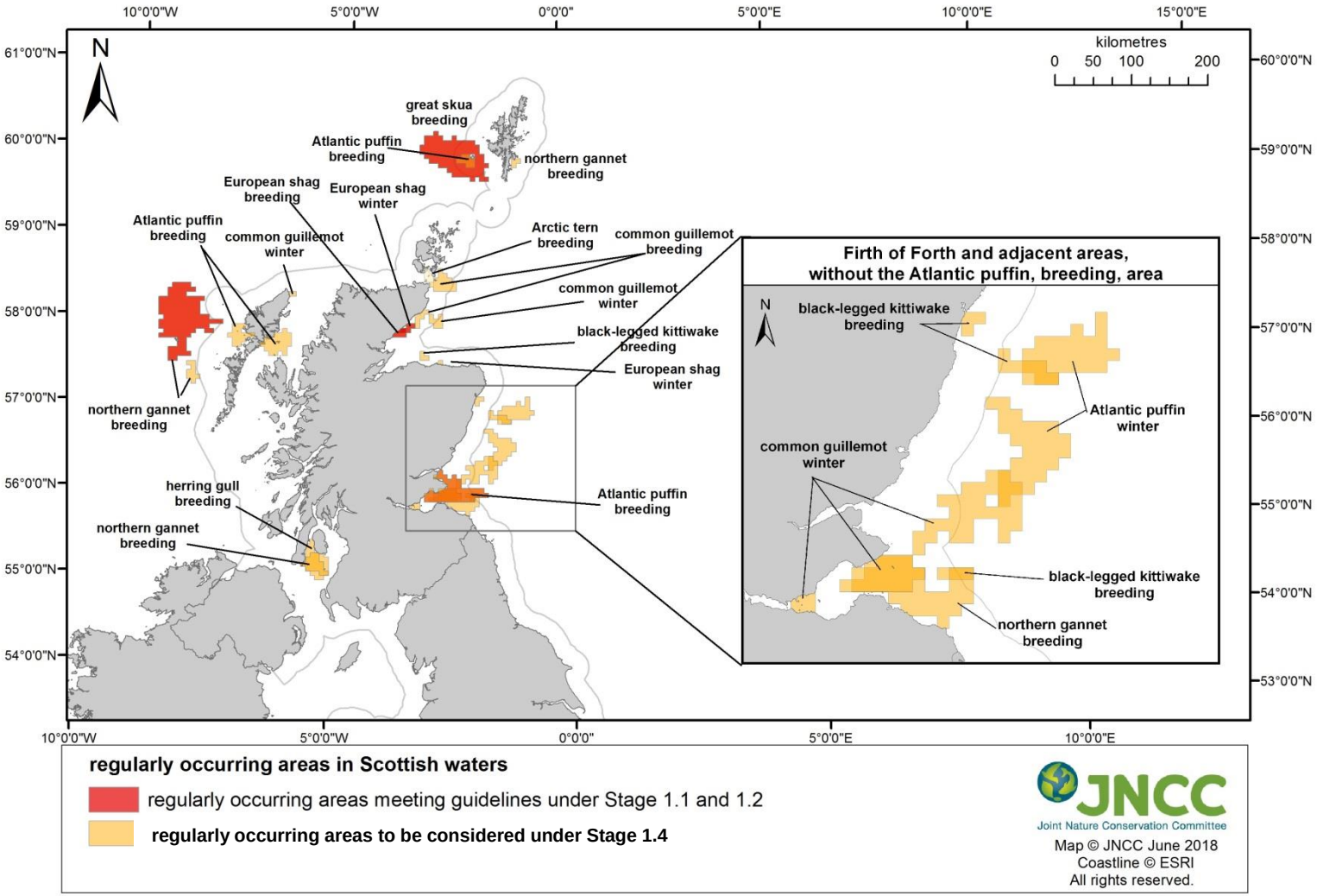

Figure 6: The locations of areas identified during the analysis carried out by JNCC

7.2.3 Site selection - ESAS areas

Of the 28 areas identified by JNCC, 20 were located mostly in Scottish inshore waters (within 12nm) and were considered for site selection by SNH in collaboration with JNCC. The offshore areas were considered separately by JNCC in collaboration with SNH. Details of the Stage 1 and Stage 2 assessments carried out by JNCC for the offshore areas are provided in the JNCC supplementary advice document. This paper concentrates on the site selection process carried out by SNH for the inshore areas.

Figure 7 provides an overview of the process of site selection carried out by SNH for seabird aggregations.

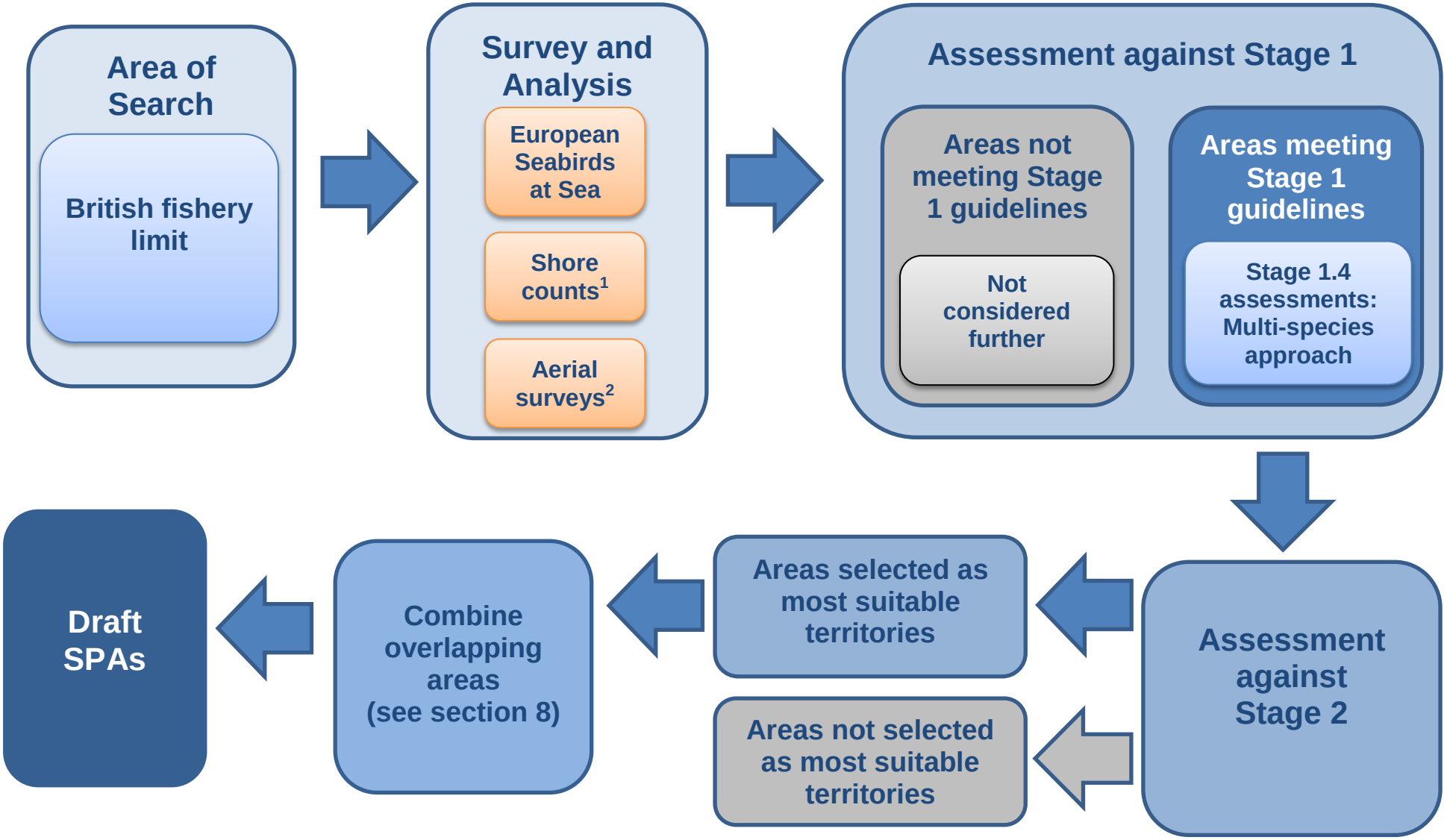

Figure 7: Overview of the site selection process for seabird aggregations
[1] European shag, [2] little gull

7.2.4 Stage 1.1-1.3 assessment of the ESAS areas

There were no areas for Annex 1[24] species meeting the population threshold required under Stage 1.1. Only two seabird areas met the required population threshold for Stage 1.2: both breeding and non-breeding shag in the Moray Firth.

The JNCC ESAS analysis also identified the Outer Firth of Forth as holding overlapping areas of breeding and non-breeding seabirds. Many of these also overlapped with qualifying areas for seabird species identified through other areas of marine survey work, including non-breeding little gull (identified through the inshore wintering waterfowl work (section 7.1)), foraging areas for breeding terns (section 7.3), areas for European shag (section 7.5) and roosting areas for wintering gulls (section 7.6). The combined seabird aggregations within the Outer Firth of Forth met the population threshold of 20,000 individuals in both the breeding and non-breeding seasons, therefore meeting Stage 1.3 for both a breeding seabird assemblage and a non-breeding seabird assemblage. The main components of the respective assemblages were confirmed once the SPA boundary was defined and included all species meeting the required population threshold (1% of the GB population or 2,000 individuals) in the final boundary to be considered as named qualifiers (section 6.3).

7.2.5 Additional seabird migratory species under Stage 1.4

As recognised by the SPA Review 2001 (Stroud et al., 2001), the UK is exceptionally important for many populations of breeding seabirds. The importance of Scotland to seabird species is reflected in the existing terrestrial SPA network with 31 colony SPAs classified. However, at sea their foraging activities are generally more dispersed and as a result only two inshore proposed SPAs (Moray Firth and the Outer Firth of Forth) met the Stage 1.1 – 1.3 guidelines.

Scotland's seabird breeding colonies support multiple species, with individuals returning each year to the same colony from their largely pelagic wintering existence. Having identified areas qualifying under Stage 1.2 and Stage 1.3, SNH assessed the remaining areas against the decision principles established for inshore wintering waterfowl (section 7.1.4) for considering additional species under Stage 1.4.

Seabird species became candidates for inclusion in a SPA where they occurred in numbers in excess of 1% of their GB population and where their distribution overlapped with species qualifying under Stage 1.1 or Stage 1.2 from the other areas of marine survey work.

Only one of the remaining areas; breeding common guillemot at the Pentland Firth overlapped with the foraging area identified for breeding Arctic terns (section 7.3). This area had previously been identified through the ESAS analysis as meeting Stage 1.2 for breeding common guillemot however; in 2014 the relevant biogeographic populations for each species used to establish the Stage 1.2 threshold were aligned with those used in the 2001 SPA Review for consistency. This meant that the Pentland Firth population of breeding guillemot no longer met the population estimate for qualifying under Stage 1.2.

Because the guillemot distribution at Pentland Firth overlapped with suitable territories identified for inshore wintering waterfowl and breeding Arctic tern SNH decided to take forward breeding common guillemot under Stage 1.4. Common guillemot was therefore included as a qualifying species of the Scapa Flow and Pentland Firth draft SPA.

[24] Qualifying numbers of little gull were identified from the inshore wintering waterfowl survey programme

The results of the Stage 1 assessment for seabird aggregations identified through the ESAS analysis are shown in Table 6.

Table 6: Scottish inshore (<12nm) seabird hotspots meeting Stage 1 guidelines

(Location selected for foraging seabirds are highlighted blue)

Hotspot number ID	Location	Species meeting the qualifying population thresholds for stages 1.1 - 1.3	Seabird aggregations qualifying under Stage 1.4	Comments on hotspots not considered further.
9	Noss - Shetland			Gannet (breeding) – not considered to qualified. Hotspot >1% GB population but did not overlap areas identified for species qualifying under Stage 1.1 or 1.2.
10	Outer Firth of Forth	Gannet (breeding) – qualifies under Stage 1.3 with >1% GB population and overlapped areas identified for other seabirds under Stage 1.3 and, Arctic tern and common tern under Stage 1.1. The combined seabird assemblage population estimate exceeding 20,000.		
11	Kilbrannan Sound			Gannet (breeding) – not considered to qualified. Hotspot >1% GB population but did not overlap areas identified for species qualifying under Stage 1.1 or 1.2.
13	Moray Firth	European shag (breeding) - qualifies under Stage 1.2 with >1% biogeographical population.		
14 & 15	Moray Firth	European shag (non-breeding) - qualifies under Stage 1.2 >1% biogeographical populations (when hotspots combined).		
18	Outer Moray Firth			Kittiwake (breeding) – not considered to qualified. Hotspot>1% GB population but did not overlap areas identified for species qualifying under Stage 1.1 or 1.2.
20	Aberdeen Bay			Kittiwake (breeding) – not considered to qualified. Hotspot >1% GB population with small overlap with area identified for species qualifying under Stage 1.1 (majority of hotspot not overlapping).

Hotspot number ID	Location	Species meeting the qualifying population thresholds for stages 1.1 - 1.3	Seabird aggregations qualifying under Stage 1.4	Comments on hotspots not considered further.
21	Outer Firth of Forth	Kittiwake (breeding) – qualifies under Stage 1.3 with >1% GB population and overlapped areas identified for other seabirds under Stage 1.3. The combined seabird assemblage population estimate exceeding 20,000.		
23	Kilbrannan Sound			Herring gull (breeding) – not considered to qualified. Hotspot >1% GB population but did not overlap areas identified for species qualifying under Stage 1.1 or 1.2.
24	Pentland Firth			Arctic tern (breeding) subject to separate marine survey programme.
26	Pentland Firth		Guillemot (breeding) – qualifies under Stage 1.4 with >1% GB population and overlapped areas identified for Arctic tern under Stage 1.1.	
27	East Caithness coast			Guillemot (breeding) - not considered to qualify. Hotspot >1% GB population but did not overlap areas identified for species qualifying under Stage 1.1 or 1.2.
28	North Isle of Lewis			Guillemot (non-breeding) - not considered to qualified. Hotspot >1% GB population but did not overlap areas identified for species qualifying under Stage 1.1 or 1.2.
30 & 31	Outer Firth of Forth	Guillemot (non-breeding) – qualifies under Stage 1.3 with >1% GB population and overlapped areas identified for little gull under Stage 1.1. Combined seabird assemblage population estimate exceeding 20,000.		
33	Outer Firth of Forth	Atlantic puffin (breeding) – qualifies under Stage 1.3 with >1% GB		

Hotspot number ID	Location	Species meeting the qualifying population thresholds for stages 1.1 - 1.3	Seabird aggregations qualifying under Stage 1.4	Comments on hotspots not considered further.
		population and overlapped areas identified for other seabirds under Stage 1.3 and Arctic tern and common tern under Stage 1.1. The combined seabird assemblage population estimate exceeding 20,000.		
35	Seas off south Lewis			Atlantic puffin (breeding) >1% GB population but did not overlap areas identified for species qualifying under Stage 1.1 or 1.2.
36	Seas off the Shiants			Atlantic puffin (breeding) >1% GB population but did not overlap areas identified for species qualifying under Stage 1.1 or 1.2.
41	Outer Firth of Forth	Breeding seabird assemblage		

7.2.6 Stage 1.1-1.3 assessment of seabird aggregations from the other marine survey programmes

Table 7 provides an overview of the other areas for seabird aggregations identified through the other survey programmes as meeting Stage 1. Further details on the Stage 1 selection process for these seabird aggregations are provided in the relevant sections as indicated by Table 7.

Table 7: Scottish inshore (<12nm) seabird areas meeting Stage 1 guidelines

Area	Marine survey programme	Species meeting the qualifying population thresholds for Stages 1.1 - 1.3 or Stage 1.4 using the multi-species approach population threshold
North Orkney	Inshore wintering waterfowl – shore counts (section 7.1)	European shag (non-breeding) -qualifies under Stage 1.4
Scapa Flow	Inshore wintering waterfowl – boat counts (section 7.1)	European shag (non-breeding) - qualifies under Stage 1.2
Pentland Firth	Important areas for foraging breeding terns (section 7.3)	Arctic tern (breeding) – qualifies under Stage 1.1
Ythan Estuary, Sands of Forvie and Meikle Loch	Important areas for foraging breeding terns (section 7.3)	Sandwich tern and little tern (breeding) – qualify under Stage 1.1
Isle of May	Important areas for European shag (section 7.5)	European shag (breeding) - qualifies under Stage 1.2
Firth of Forth	Important areas for foraging breeding terns (section 7.3)	Arctic tern and common tern (breeding) – qualify under Stage 1.1
Firth of Forth and Firth of Tay	Inshore wintering waterfowl – aerial surveys (section 7.1)	Little gull (non-breeding) - qualifies under Stage 1.1
Firth of Forth	Winter Gull Roost Survey (section 7.6)	Black-headed gull, common gull and herring gull (non-breeding) – qualify under Stage 1.3
Solway Firth	Winter Gull Roost Survey (section 7.6)	Black-headed gull, common gull and herring gull (non-breeding) – qualify under Stage 1.3

7.2.7 Stage 2 assessment for seabird aggregations

Stage 2 is designed to identify the most suitable territories from all possible areas meeting the Stage 1 assessments. Stage 2 assessments were carried out once the indicative SPA boundaries (see section 8). For all species other than non-breeding European shag, the seabird aggregations identified as meeting the Stage 1 requirements represented the largest or second largest population of each species in their respective season in Scotland. As such, they met Stage 2.1 guideline (population size) and Stage 2.2 guideline (range) being the most important populations in size and representing the northern extent of each species geographical range in the UK.

Non-breeding European shag was represented in four indicative SPAs (North Orkney, Scapa Flow, Moray Firth and the Firth of Forth and Tay Bay) (see section 7.5).

All inshore areas including seabird aggregations also supported multi-species interests and therefore met the Stage 2.5 guideline (multi-species area).

Stage 2 assessments by SNH of all seabird aggregations[25] supported the selection of three inshore areas as the most suitable territories using the UK SPA Selection Guidelines:

[25] Terns and wintering gulls are considered separately in sections 7.3 and 7.6, respectively

- Outer Firth of Forth and St Andrews Bay Complex
- Moray Firth
- Pentland Firth

The JNCC Stage 1 and Stage 2 assessments of the offshore seabird aggregations also identified two areas as the most suitable territories:

- Foula
- St Kilda

7.3 Foraging areas for breeding Arctic, common, Sandwich and little terns

There are five species of tern that breed in the UK (Arctic, common, Sandwich, roseate and little tern) and all are listed as rare and vulnerable on Annex 1 of the Birds Directive. The UK has classified 57 terrestrial SPAs that include one or more tern species as a qualifying species. The existing SPAs protect the colony population and the areas terns use on land for breeding, nesting and roosting. The marine areas used for foraging however fall outwith the existing network of tern colony SPAs.

During the breeding season terns make multiple daily foraging trips back and forth from their breeding colony to feed their young. This activity restricts their foraging range to feeding areas with abundant prey relatively close to the breeding colony. Access to these feeding areas is essential for their survival and reproductive success.

7.3.1 Areas of Search – foraging areas surrounding existing tern colony SPAs

The starting point for identifying important feeding areas for the five species of tern was the 57 colony SPAs. These SPAs had already been identified as supporting more than 1% of the relevant GB population. Unlike most other seabirds which can disperse over large areas to forage during the breeding season, terns forage relatively close to their breeding colonies. Therefore, it is reasonable to expect that the marine waters surrounding their breeding colonies provide essential foraging areas for SPA qualifying populations. Consequently, cited population estimates from the existing tern colony SPAs were used to provide the baseline populations for the foraging areas and there was no separate assessment of the numbers of terns using the marine foraging areas.

Since resource and time constraints prevented detailed surveys at all 57 colony SPAs across the UK, a statistical modelling approach was taken which used data collected from a sub-sample of colonies to a) characterise the types of marine environment that is used by foraging terns, and b) use this information to identify potential feeding habitats within foraging range of the existing colony SPAs.

There are 21 tern colony SPAs in Scotland (Table 8). Of these, 13 colonies were known to be recently occupied[26] and their predicted foraging areas were identified as part of the JNCC modelling analysis (Figure 8).

[26] For large terns, recent occupation was defined as the mean of peaks over the most recent five years up to 2009 for which data are available equalled or exceeded 25 Apparently Occupied Nests (AON) (Wilson et al., 2014). For little terns, recent occupation was defined where the mean of peaks of the most recent five years of data equalled or exceeded the UK SPA selection guideline of 1% of GB population (19 pairs).

Table 8: Breeding tern colonies in Scotland

Tern species (highlighted red) within tern colony SPAs which were considered no longer as 'recently occupied' and therefore colonies (highlighted grey) fell outwith the scope of JNCC's modelling analysis.

SPA name	**Arctic tern**	**Common tern**	**Sandwich tern**	**Roseate tern**	**Little tern**
Auskerry	X				
Cromarty Firth		X			
Fair Isle	X				
Fetlar	X				
Firth of Tay and Eden Estuary					X
Forth Islands	X	X	X	X	
Foula	X				
Glas Eileanan		X			
Imperial Dock Lock, Leith		X			
Inner Moray Firth		X			
Loch of Strathbeg			X		
Monach Isles		X			X
Mousa	X				
Papa Stour	X				
Papa Westray	X				
Pentland Firth Islands	X				
Rousay	X				
South Uist Machair and Lochs					X
Sumburgh Head	X				
West Westray	X				
Ythan Estuary, Sands of Forvie and Meikle Loch		X	X		X

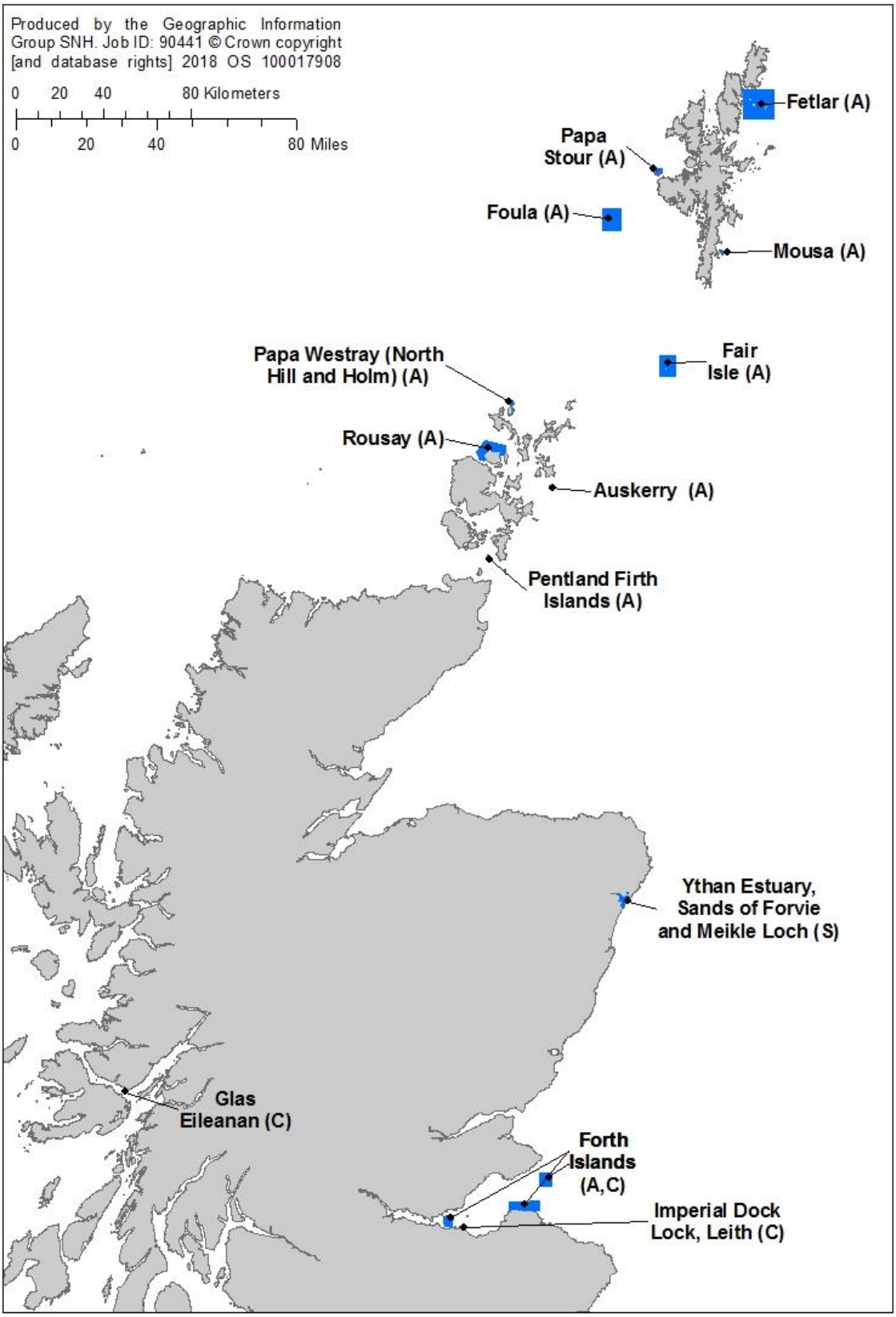

Figure 8: Tern colony SPAs and the relevant tern species which were covered by the JNCC analysis.

(A = Arctic tern, C = common tern, R = roseate tern and S = Sandwich tern)

Two approaches were used by JNCC to establish the extent of the foraging areas used by large terns for the 13 tern colonies identified in Table 9. JNCC collected tracking data from three large tern colonies within Scotland: Forth Islands and Glas Eileanan for common terns and Ythan Estuary, Sands of Forvie and Meikle Loch for Sandwich terns. These were considered "data-rich" colonies. For colonies where there was no site-specific tracking data, a generic model using tracking data from suitable colonies across the UK was applied to identify foraging areas. These colonies are referred to as "data-poor".

Full details of the analysis can be found in JNCC report 500 (Wilson et al., 2014) for large tern species (common tern, Arctic tern and Sandwich tern) and JNCC report 548 (Parsons et al., 2015) for little tern. Non-technical summaries are provided in:

- Tern marine SPA identification: Tracking data collection and analysis.
- Identification of important marine areas for little terns around breeding colony SPAs.

7.3.2 Site selection of foraging areas for breeding terns

The 13 foraging areas assessed by JNCC were considered for site selection by SNH. In deciding which areas were scientifically robust and therefore appropriate for taking forward for site selection, SNH took account of whether the modelled predicted foraging areas were based on data-rich (site-specific tracking surveys) or data-poor colonies (generic model). In agreement with SNH's Scientific Advisory Committee sub-group only data-rich colonies were considered for stand-alone tern foraging SPAs meeting Stage 1.1. It was also agreed, partly because of the ephemeral nature of most tern colonies that data-poor colonies could only be considered where they formed a multi-species (Stage 2.5) component when overlapping with areas qualifying under Stage 1.1 or 1.2 for other marine birds (i.e. inshore wintering waterfowl, seabird aggregations or foraging areas for breeding red-throated diver).

Figure 9 provides an overview of the process of site selection carried out to identify feeding areas for terns.

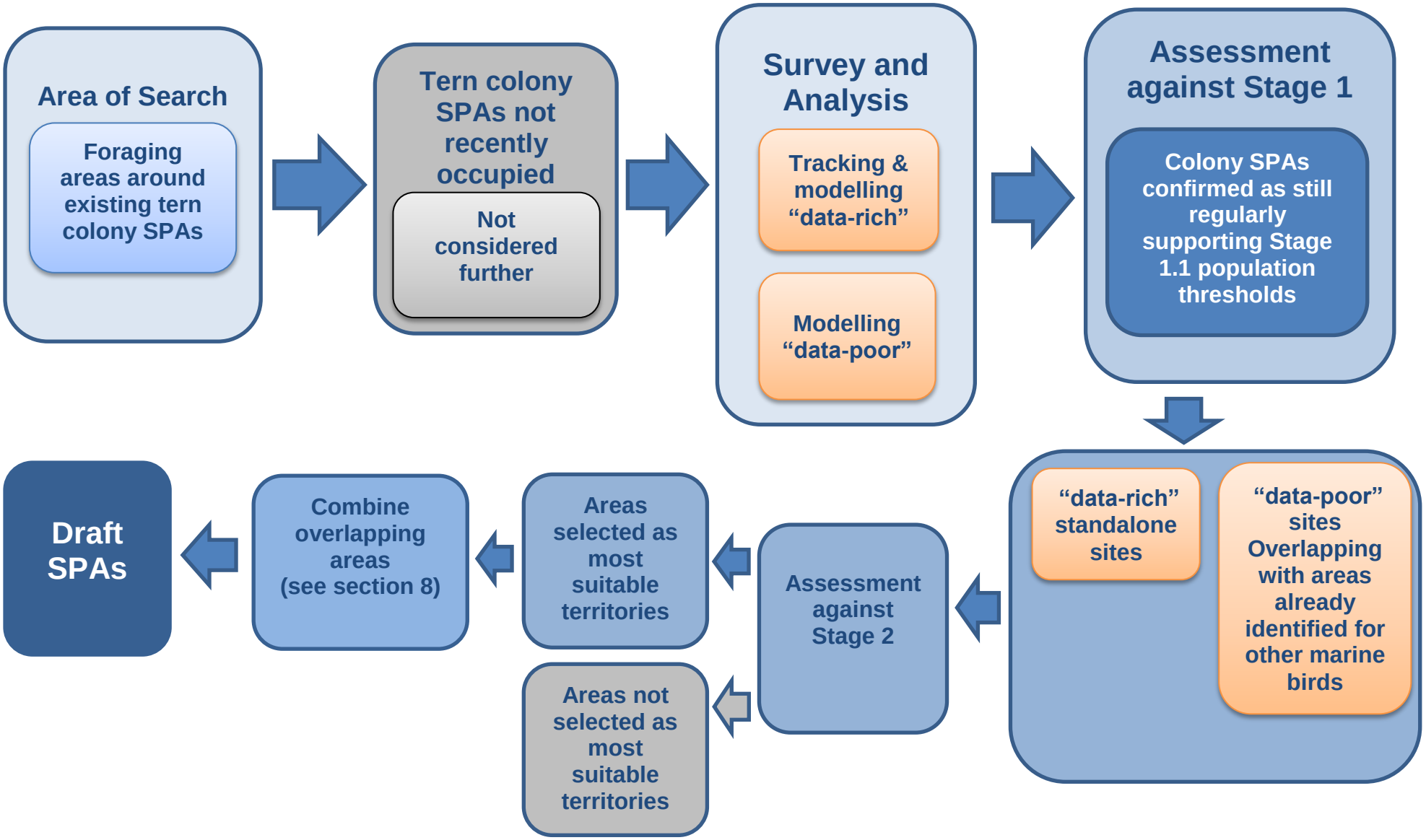

Figure 9: Overview of the process of site selection carried out to identify foraging areas for terns

7.3.3 Stage 1 assessment of foraging areas for breeding large terns

The selection process restricted the identification of important foraging areas for large tern species to two stand-alone tern foraging areas (the data-rich colonies: Forth Islands for common terns and Ythan Estuary, Sands of Forvie and Meikle Loch for Sandwich tern) and four previously identified indicative marine SPAs where tern could be added (the data-poor colonies: Forth Islands, Rousay and Pentland Firth for Arctic tern and Imperial Dock Lock, Leith for common tern). Table 9 provides an overview of the considerations used to determine whether foraging areas should be considered further under Stage 1.

Table 9: Results of Stage 1 assessment of inshore foraging areas for large tern species.

(Sites selected for foraging tern species are highlighted blue.)

SPA name	Qualifying species	Overlapping marine interest	Additional comments influencing site proposal
Auskerry	Arctic tern	None	Data-poor colony and no multi-species interests.
Fair Isle	Arctic tern	None	Data-poor colony and no multi-species interests.
Fetlar	Arctic tern	Foraging areas for breeding red-throated diver	Data-poor colony with multi-species interest. However, as a result of more recent declines in Arctic tern populations in Shetland, SNH's Scientific Advisory Committee advised that Arctic tern should not be considered as a qualifying feature of Fetlar
Forth Islands	Arctic tern, common tern	Inshore wintering waterfowl & foraging areas for seabird aggregations	Data-rich colonies with multi-species interests.
Foula	Arctic tern	Foraging areas for seabird aggregations	Data-poor colony with multi-species interest. Offshore area considered by JNCC.
Glas Eileanan	Common tern	None	Data-poor colony and no multi-species interests.
Imperial Dock Lock, Leith	Common tern	Inshore wintering waterfowl	Data- poor colony with multi-species interests.
Mousa	Arctic tern	None	Data-poor colony with no multi-species interests.
Papa Stour	Arctic tern	None	Data-poor colony with no multi-species interests.
Papa Westray	Arctic tern	None	Data-poor colony and no multi-species interests.
Pentland Firth Islands	Arctic tern	Inshore wintering waterfowl & foraging areas for seabird aggregations	Overlap with multi-species interests.
Rousay	Arctic tern	Inshore wintering waterfowl & foraging areas for breeding red-throated diver	Overlap with multi-species interests.
Ythan Estuary, Sands of Forvie and Meikle Loch	Sandwich tern	Little tern	Data-rich colonies with multi-species interests.

7.3.4 Stage 2 assessment of foraging areas for breeding large terns

Three foraging areas were identified for Arctic tern, two for common tern (both in the Firth of Forth) and one for Sandwich tern. For Arctic tern, the foraging areas (identified through the generic model from data poor colonies) overlapped with qualifying areas identified for other breeding seabirds and were therefore selected because they met Stage 2.5 (multi-species area). The foraging areas identified for common tern and Sandwich tern are predicted to support the largest or second largest population of each species. As such, they met Stage 2.1 guideline (population size) and Stage 2.2 guideline (range) being the most important populations in size and representing the northern extent of each species geographical range in the UK. The foraging areas for these species also supported multi-species interests and therefore met the Stage 2.5 guideline (multi-species area).

7.3.5 Stage 1 and 2 assessment of foraging areas for breeding little tern (Parsons et al., 2015)

Only one tern colony SPA (Ythan Estuary, Sands of Forvie and Meikle Loch) in Scotland regularly supports more than 1% of the GB population of little tern (meeting Stage 1.1) and could be considered for site selection.

The foraging area off the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is predicted to support the largest population of little tern in Scotland. As such, the foraging area met Stage 2.1 guideline (population size) and Stage 2.2 guideline (range) being the most important populations in size and representing the northern extent of little terns geographical range in the UK. The foraging areas also supports Sandwich tern (qualifying under Stage 1.1) and therefore met the Stage 2.5 guideline (multi-species area).

7.3.6 Areas identified as most suitable territories for foraging terns

In Scotland, foraging areas around five tern colonies were selected:

- Forth Islands
- Imperial Dock Lock, Leith
- Rousay
- Pentland Firth Islands
- Ythan Estuary, Sands of Forvie and Meikle Loch

7.4 Foraging areas for breeding red-throated divers

The entire UK breeding population of red-throated diver occurs in Scotland, with approximately 33% in Shetland, 8% in Orkney, 26% in the Outer Hebrides, 17% in the Inner Hebrides, and 17% elsewhere in Scotland (Dillon et al., 2009).

Breeding red-throated divers forage almost entirely in inshore marine areas close to their freshwater breeding territories (Reimchen and Douglas, 1984; Gibbons et al.,1997; Okill and Wanless,1990). During the chick-rearing period (July and August), breeding birds make particularly intensive use of these inshore waters, with a breeding pair making as many as 10-18 foraging trips every 24 hours (depending on chick age; Reimchen and Douglas, 1984). Post-fledging (during August), the chicks are initially brought to the same inshore marine areas (Okill and Wanless, 1990; Ben Dean pers. obs.), where their parents continue to feed them, before leaving the breeding areas (Okill, 2002). At this stage, both breeding adults and their fledged young spend a large proportion of their time on the sea.

Marine SPAs can play an important role in protecting red-throated diver while away from their nest sites. In addition to the protection already afforded to them by existing terrestrial SPAs, marine SPAs will protect the marine habitats and prey these birds rely on and help to avoid impacts that may result in increased foraging effort and reduced breeding success, as well as increasing resilience to wider-scale impacts (see Annex 1).

7.4.1 Areas of Search – foraging areas surrounding nesting sites

The Areas of Search for this work was the marine environment within the foraging range of nesting sites identified from the breeding red-throated diver national survey (Dillon et al., 2006).

The analysis carried out by JNCC identified 36 distinct marine areas spread across the species breeding range. These included 14 predicted foraging areas in the Northern Isles and 22 predicted foraging areas in the Hebrides. No foraging areas were identified around the breeding territories of red-throated divers located in Caithness due to the dispersed nature of the nest sites and few areas deemed as ‘suitable habitat’. Therefore no site selection assessment could be made for foraging areas supporting mainland breeding red-throated divers.

The locations of the predicted foraging areas for red-throated diver are shown in Figure 10.

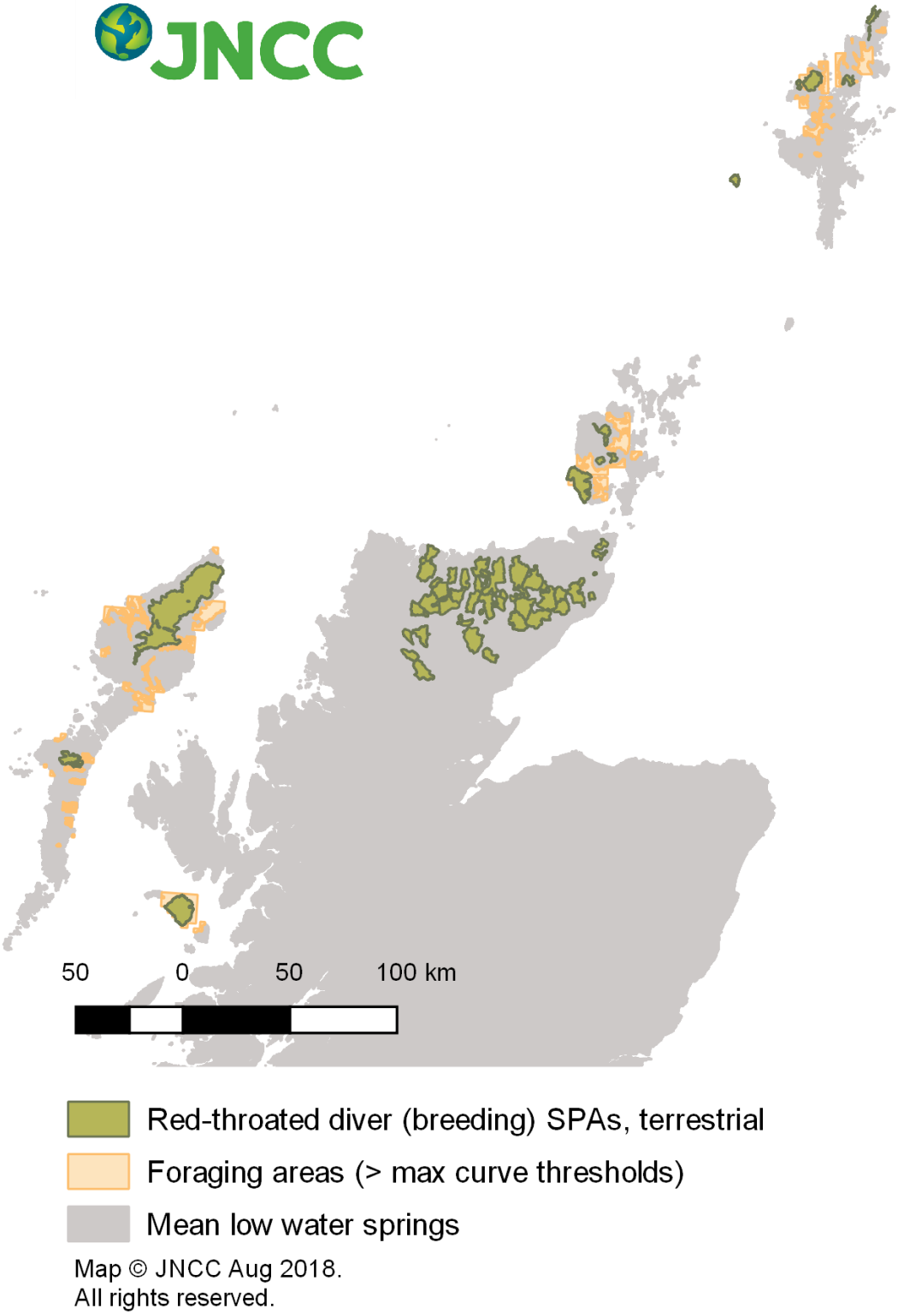

Figure 10: Predicted foraging areas for breeding red-throated divers.

Full details of the analysis can be found in JNCC report 541 (Black et al., 2015) and non-technical summary: Red-throated diver marine SPA identification: Data collection and analysis.

7.4.2 Site selection of important foraging areas for breeding red-throated diver

The 36 predicted foraging areas identified by JNCC were considered by SNH for site selection. In deciding which areas to take forward for site selection under Stage 1, SNH took account of the foraging areas being based on a non-site specific model reflecting predicted numbers rather than definite numbers. In agreement with SNHs' Scientific Advisory Committee sub-group areas were only selected where they overlapped with areas already identified for other marine birds qualifying under Stage 1.1 or 1.2 (i.e. inshore wintering waterfowl, seabird aggregations or foraging areas for breeding terns).

Figure 11 provides an overview of the process of site selection carried out to identify foraging areas for breeding red-throated divers.

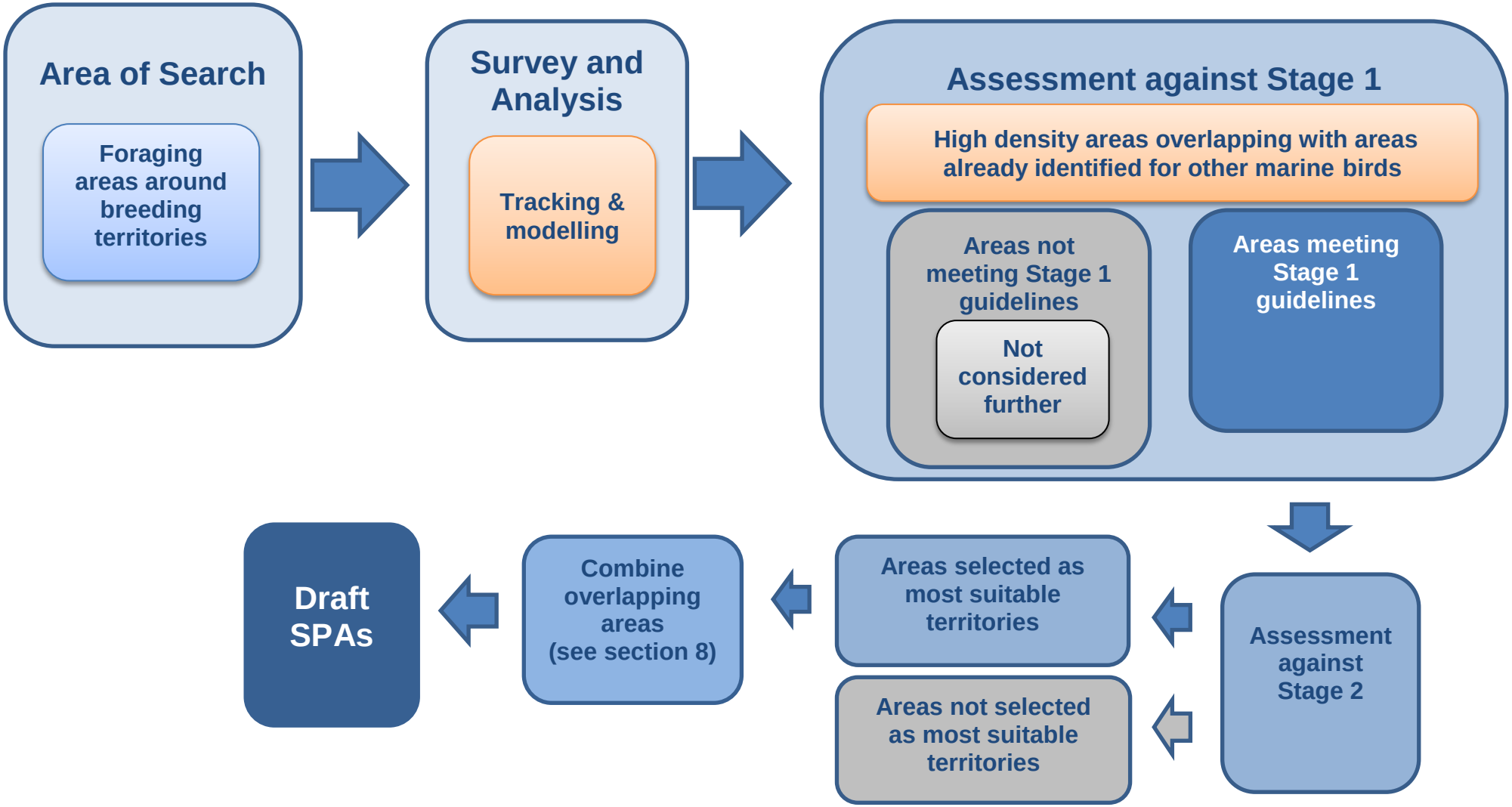

Figure 11: provides an overview of the process of site selection carried out to identify foraging areas for breeding red-throated divers.

7.4.3 Stage 1 assessment of foraging areas for breeding red-throated divers

Of the 36 foraging areas predicted to support high densities of breeding red-throated diver, five areas overlapped with areas already selected for other qualifying marine birds and were predicted to support at least 1% of the breeding red-throated diver GB population: Two in Shetland, two in Orkney and one in the Hebrides (Table 10). In the Hebrides, because there was incomplete survey coverage, only areas within the foraging range of terrestrial SPAs supporting at least 1% of the GB population of nesting red-throated divers were considered to meet Stage 1.1. The addition of red-throated diver to the existing marine extension at Rum SPA was also identified as a potential site because red-throated diver are a qualifying feature of the SPA and their foraging area overlapped with the existing marine extension for the SPA. These six areas were considered further under the Stage 2 guidelines.

7.4.4 Stage 2 assessment of important foraging areas for breeding red-throated divers

The focus for application of the Stage 2 guidelines was ensuring that areas supporting the largest populations of breeding red-throated divers covering their full geographic range (Shetland, Orkney, Hebrides and Caithness) were selected as the most suitable areas and therefore represented in the network of marine SPAs.

The six foraging areas identified for red-throated diver are predicted to support the largest or second largest number of birds in three of the four key regions (Shetland, Orkney and the Hebrides, none in Caithness) supporting breeding red-throated divers in the UK. As such, they met Stage 2.1 guideline (population size) and Stage 2.2 guideline (range) being the most important populations in size and representing the full geographical range of the species in the UK. The foraging areas also supported multi-species interests and therefore met the Stage 2.5 guideline (multi-species area).

Table 10: Stage 1 and 2 assessment of foraging areas for breeding red-throated divers

Red-throated diver foraging area	**% of GB population for breeding red-throated diver in indicative SPAs[27]**	**Population size and density (Stage 2.1)**	**Species range (Stage 2.2)**	**Multi-species area (Stage 2.5)[28]**
Fetlar, Shetland (Bluemull and Colgrave Sound draft SPA)	13.9 %	Supported the largest predicted number of pairs in Shetland at high densities. This was the largest of all marine areas assessed. Most important area in Shetland.	The Northern Isles are the UK stronghold for breeding red-throated diver. This site is the most northern of all sites and one of two in Shetland representing the northern extremity of red-throated diver GB range.	Two Annex 1 species (Arctic tern[29] and red-throated diver)
Dales Voe, Shetland (East Mainland Coast, Shetland draft SPA)	10.5%	Supported the 2nd largest predicted number of pairs in Shetland mostly at low densities.	The Northern Isles are the UK stronghold for breeding red-throated diver. This site is one of two in Shetland representing the northern extremity of red-throated diver GB range.	Three Annex 1 species (Red-throated diver, great northern diver and Slavonian grebe) and three migratory species (common eider, long-tailed duck and red-breasted merganser)
North Orkney (North Orkney draft SPA)	4.4%	Supported the 2nd largest predicted number of pairs in Orkney.	The Northern Isles are the UK stronghold for breeding red-throated diver. This site is one of two in Orkney representing the southern extremity of red-throated diver GB range.	Four Annex 1 species (Red-throated diver, great northern diver, Slavonian grebe and Arctic tern) and five migratory species (Velvet scoter, common eider, long-tailed duck, red-breasted merganser and European shag).
Scapa Flow (Pentland Firth and Scapa Flow draft SPA)	7.7%	Supported the largest predicted number of pairs in Orkney. Most important area in Orkney.	The Northern Isles are the UK stronghold for breeding red-throated diver. This site is one of two in Orkney representing the southern extremity of red-throated diver GB range.	Five Annex 1 species (Red-throated diver, great northern diver, black-throated diver, Slavonian grebe and Arctic tern) and seven migratory

[27] These percentages are based on the predicted number of red-throated divers calculated for the draft SPA boundaries. Population estimates provided in the proposed SPAs reflect changes to boundaries during the process of confirming the final network of SPAs for consultation (see section 9)
[28] Multi-species assessment is based on qualifying species identified for the draft SPA boundaries.
[29] As a result of declines in Arctic tern populations in Shetland, SNH's Scientific Advisory Committee advised that Arctic tern should not be considered as a qualifying feature of Fetlar.

Red-throated diver foraging area	% of GB population for breeding red-throated diver in indicative SPAs[27]	Population size and density (Stage 2.1)	Species range (Stage 2.2)	Multi-species area (Stage 2.5)[28]
				species (Common scoter, common goldeneye, common eider, long-tailed duck, red-breasted merganser, European shag and common guillemot).
West coast of Outer Hebrides (West coast of Outer Hebrides draft SPA)	4.4%	Supported the largest predicted number of pairs in the Outer Hebrides.	This site is the only site in the Outer Hebrides, a key component of the species breeding range in the UK, representing the western extremity of red-throated diver GB range.	Three Annex 1 species (Red-throated diver, great northern diver and black-throated diver) and three migratory species (Common eider, long-tailed duck and red-breasted merganser).
Rum (Rum SPA)	1.4%	Supported the largest predicted number of pairs in the Inner Hebrides.	This site is the only site in the Inner Hebrides, one of two representing the western extremity of red-throated diver GB range.	One Annex 1 species (Red-throated diver) and one migratory species (Manx shearwater)

In Scotland, six foraging areas for breeding red-throated diver were selected:

- Fetlar, Shetland
- Dales Voe, Shetland
- North Orkney
- Scapa Flow
- West coast of Outer Hebrides
- Rum

7.5 Important foraging areas for European shag

There are 13 colony SPAs in place to protect shags during the breeding season. Of these, 11 are in Scotland and two are in England coinciding with Scotland supporting 78% of the GB breeding population (Mitchell et al., 2004).

During the breeding season shags make multiple daily foraging trips back and forth from their breeding colony to feed their young. This activity restricts their foraging range to feeding areas with abundant prey relatively close to the breeding colony. Access to these feeding areas is essential for their survival and reproductive success.

Non-breeding birds tend to remain within 50km of their breeding site (Wernham et al., 2002) during the non-breeding season with approximately 80-90% of the UK population occurring in Scotland (Austin et al., 2017, Furness 2015); therefore there is negligible movement of birds into and out of UK waters and birds wintering in GB waters are likely to be GB breeding birds (Furness 2015). There are no existing SPAs for non-breeding European shag.

Marine SPAs can play an important role in protecting the marine habitats and prey species, such as sandeel, used by birds from existing colony SPAs in both the breeding and non-breeding seasons, as well as increasing resilience to wider-scale impacts (see section 4). Site-based protection also promotes resilience to sporadic population “wrecks” that shags are subject to and which may depress breeding populations over a number of subsequent years (Heubeck et al., 2015)[30].

7.5.1 Areas of Search – approaches used for European shag

The approach taken for shag was to identify important areas based on data from a variety of sources. European shag feed relatively close inshore both during the breeding season and non-breeding seasons and therefore offshore boat surveys (such as ESAS) can under-estimate numbers. Additionally, JNCC aerial surveys (as part of the inshore wintering waterfowl survey programme) have tended to exclude shags as a target species because of difficulties in distinguishing between great cormorant and European shag. A mix of approaches was therefore required with areas identified from visual boat and aerial survey (section 7.1) where observers were able to identify the species, the seabird aggregations analysis (where surveys were undertaken sufficiently close to the shore) (section 7.2) and tracking data collected by the Centre for Ecology and Hydrology (CEH) from one of the largest European shag colonies on the Isle of May (Forth Islands SPA).

Full details of the tracking data analysis can be found in JNCC report 556 (Daunt et al., 2015) and non-technical summary: Shag marine SPA identification: Data collection, collation and analysis.

[30] http://jncc.defra.gov.uk/page-2877

7.5.2 Site selection of important areas for European shag

Two areas of search from the inshore wintering waterfowl survey programme, three hotspots from the ESAS analysis and one from the tracking data analysis were considered by SNH for site selection. The locations of the breeding and non-breeding shag foraging areas are shown in Figure 12 and Figure 13 provides an overview of the process of site selection carried out to identify foraging areas for breeding European shag.

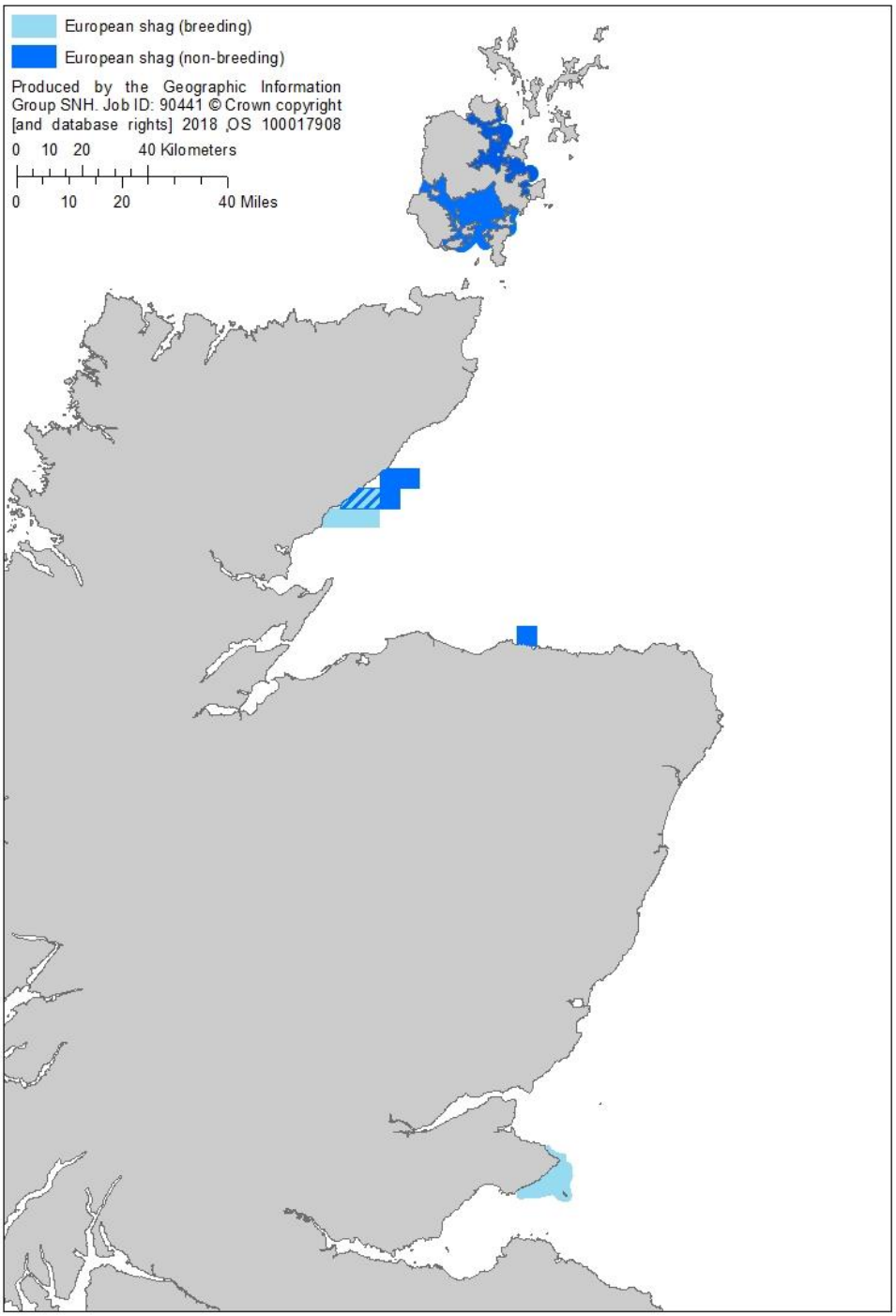

Figure 12 : Locations of important foraging areas for European shag

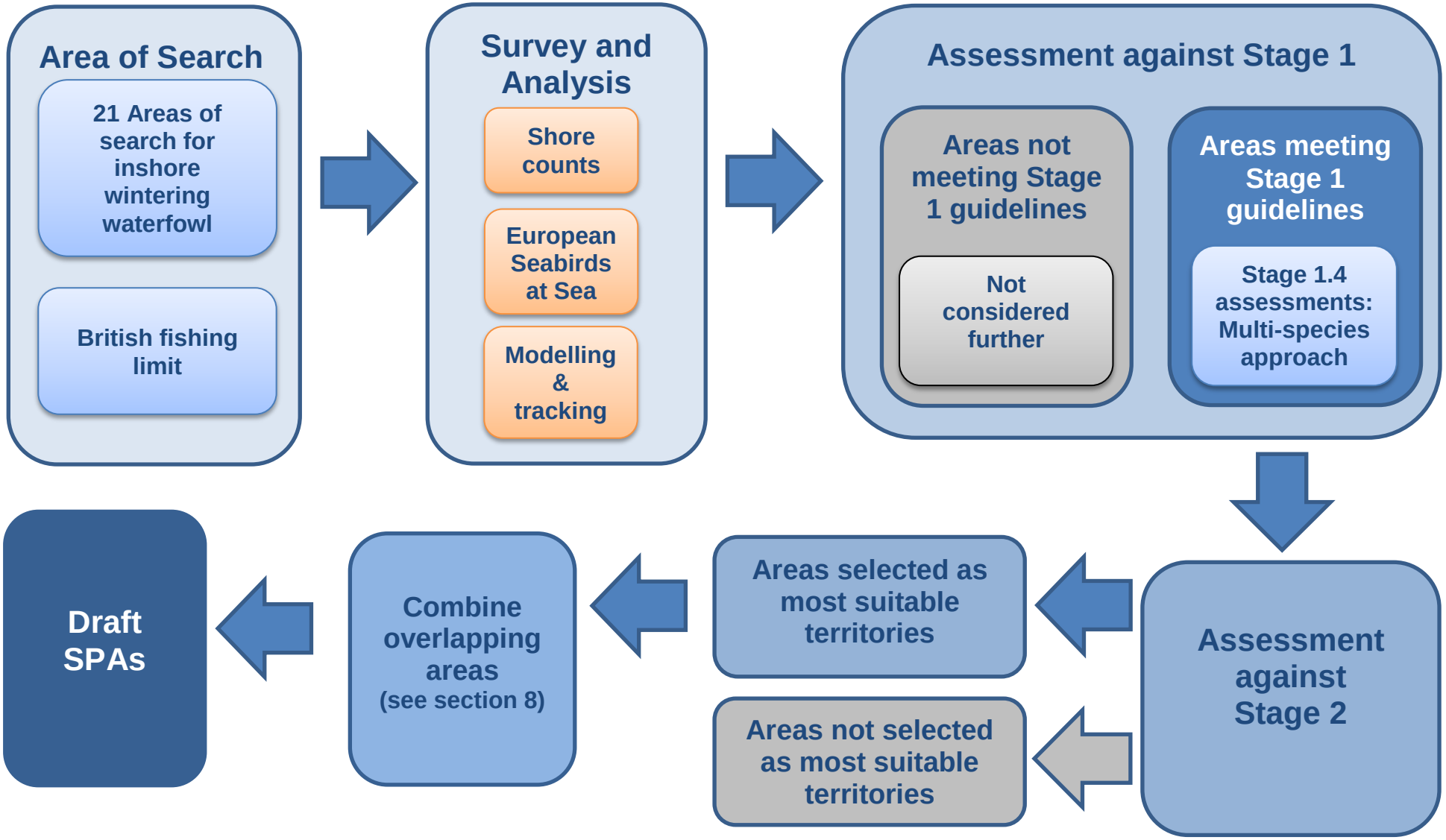

Figure 13: Overview of the process of site selection carried out to identify important areas for breeding and non-breeding European shag

7.5.3 Stage 1 assessment of foraging areas for European shag

Two foraging areas for breeding European shag fully met the requirements for qualifying under Stage 1.2: Moray Firth and the Isle of May (Firth of Forth).

Two foraging areas for non-breeding European shag fully met the requirements for qualifying under Stage 1.2: Scapa Flow and Moray Firth. Non-breeding European shag in the Firth of Forth and Firth of Tay exceeded the required population threshold for qualifying as a named qualifier of a non-breeding seabird assemblage under Stage 1.3 and the multi-species approach (section 7.1.4) also identified non-breeding shag as a qualifying feature of North Orkney.

Table 11: Marine areas meeting Stage 1 guidelines

Area	Marine survey programme	Breeding European shag	Non-breeding European shag
North Orkney	Inshore wintering waterfowl –shore counts (section 7.1)		Qualifies under Stage 1.4
Scapa Flow	Inshore wintering waterfowl –boat counts (section 7.1)		Qualifies under Stage 1.2
Moray Firth	ESAS analysis (section 7.2)	Qualifies under Stage 1.2	Qualifies under Stage 1.2
Firth of Forth and Firth of Tay	ESAS analysis (section 7.2)		Qualifies under Stage 1.3
Firth of Forth	Tracking data from the Isle of May	Qualifies under Stage 1.2	

7.5.4 Stage 2 assessment of foraging areas for European shag

The foraging areas in the Moray Firth and off the Isle of May support the largest and second largest populations of breeding European shag in the UK respectively meeting Stage 2.1 guideline. The Moray Firth represents the northern extent of European shag range in Scotland and the Outer Firth of Forth and St Andrews Bay Complex the southern extent - meeting Stage 2.2 guideline. Both foraging areas overlap with other multi-species interests meeting Stage 2.5 guideline. Therefore, both foraging areas for breeding European shag were selected as the most suitable territories.

Similarly, the foraging areas in the Moray Firth and off the Isle of May support the largest and second largest populations of non-breeding European shag in the UK respectively meeting Stage 2.1 guideline. North Orkney, Scapa Flow and Moray Firth represent the north-east extent of European shag range in Scotland and the Outer Firth of Forth and St Andrews Bay Complex the southern extent - meeting Stage 2.2 guideline. The foraging areas all overlap with other multi-species interests meeting Stage 2.5 guideline. Therefore, all foraging areas for non-breeding shag were selected as the most suitable territories.

In Scotland, four areas for European shag were selected:

- North Orkney (non-breeding shag)
- Scapa Flow (non-breeding shag)
- Moray Firth (breeding and non-breeding shag)
- Firth of Forth (breeding and non-breeding shag)

7.6 Roosting areas for wintering gulls

In addition to gull species being considered through the work on seabird aggregations, roosting sites for wintering gulls were also considered as part of the site selection process for marine SPA's. This was to address the findings of the 2001 SPA Review (Stroud et al., 2001) which concluded the SPA provision for roosting wintering gull species was insufficient[31].

Breeding gulls are represented in existing Scottish colony SPAs (kittiwakes (29 SPAs), common gulls (1 SPA), herring gulls (8 SPAs), lesser black-backed gulls (2 SPAs) and great black-backed gulls (6 SPAs)) but there are no existing terrestrial or marine SPAs supporting non-breeding gulls. Most of the large gull species including herring gull, black-headed gull and common gull spend the majority of their time in terrestrial habitats (including while foraging). However, intertidal and subtidal habitats are used by large aggregations of wintering gulls for roosting.

The 2001 Review recommended that appropriate data be collected through the Wetland Bird Survey (WeBS) and the national wintering gull survey (Winter Gull Roost Survey (WINGS)) to provide a national (UK) assessment of important areas for roosting wintering gulls and identify existing SPAs or new SPAs where gulls could be considered at an additional qualifying feature.

WINGS are conducted on land (as are WeBS) recording the number of birds returning to roost sites. Both inland sites, including reservoirs, gravel pits and lakes, and coastal sites, including estuaries, harbours, islands and near-shore coastal waters, were covered. The counts thus refer to winter gull populations associated with land with precise locations of offshore sites not recorded. As such, population estimates from WINGS may well underestimate the total populations of each species as counts exclude gulls which may have roosted offshore, not visible from land, but still within UK Territorial Waters (i.e. 12 nautical miles from shore). The results for the WINGS (Banks et al., 2007) indicates there are two large Scottish roosting areas in the Firth of Forth and the Solway Firth, both supporting numbers of non-breeding gulls (common gulls, black-headed gulls and herring gulls) which meet the UK SPA Selection Guidelines.

7.6.1 Stage 1 assessment of roosting areas for wintering gulls

No sites were identified as supporting at least 1% of the biogeographical populations required to meet Stage 1.2 guideline for migratory species. However, the presence of non-breeding gulls at both the Firth of Forth and Solway Firth contributed to a non-breeding bird assemblage qualifying under Stage 1.3 guideline. Both areas supported over 1% of the GB population of non-breeding herring gull, black-headed gull and common gull and therefore these species were included as named qualifiers of the non-breeding assemblages.

7.6.2 Stage 2 assessment of roosting areas for wintering gulls

The intertidal and sub-tidal roosting areas used by roosting wintering gulls in the Firth of Forth and Solway Firth support the only populations of non-breeding herring gull, black-headed gull and common gull meeting the Stage 1 guidelines. Both areas therefore were judged to meet Stage 2.1 and 2.2. In addition, both areas also supported multi-species interests and therefore also met the Stage 2.5 guideline. Therefore, both areas met the

[31] The 2016 review (Stroud *et al.*, 2016) identifies non-breeding insufficiencies for all seven species of gull in the UK

Stage 2.1 and 2.2 guidelines and were selected as the most suitable territories for roosting wintering gulls.

In Scotland, non-breeding black-headed gull, common gull and herring gull were included as additional qualifying species at two areas already selected for other qualifying species:

- Firth of Forth
- Solway Firth

8 Compiling the network of draft SPAs

JNCC and SNH worked together to compile the most suitable areas selected under Stage 2 and prepare boundaries to produce a network of draft SPAs composed of multiple species.

The initial focus was on the most suitable territories selected for inshore wintering waterfowl (Annex 1 species) and seabird aggregations. Where the high density areas identified for inshore wintering waterfowl species and seabird aggregations[32] overlapped, these were merged into one indicative SPA comprising both inshore wintering waterfowl and seabird aggregations. This produced nine indicative SPAs with the Firth of Forth and Firth of Tay inshore wintering waterfowl areas being combined as a result of the large overlaps with seabird aggregations in the Outer Firth of Forth:

- **East Coast Mainland, Shetland** – comprising high density areas of inshore wintering waterfowl (East Shetland, section 7.1.5). No overlap with seabird aggregations.
- **North Orkney** - comprising high density areas of inshore wintering waterfowl (North Orkney, section 7.1.5). No overlap with seabird aggregations.
- **Pentland Firth and Scapa Flow** - comprising high density areas of inshore wintering waterfowl (Scapa Flow, section 7.1.5) and high density areas of seabird aggregations (Pentland Firth, section 7.2.7).
- **Moray Firth** - comprising high density areas of inshore wintering waterfowl (Moray Firth, section 7.1.5) and high density areas of seabird aggregations (Moray Firth, section 7.2.7).
- **Firth of Forth and Tay Bay** - comprising high density areas of inshore wintering waterfowl (Firth of Forth and Firth of Tay, section 7.1.5) and seabird aggregations (Outer Firth of Forth, section 7.2.7).
- **West Coast of the Outer Hebrides** - comprising high density areas of inshore wintering waterfowl (Outer Hebrides, section 7.1.5). No overlap with seabird aggregations.
- **Coll and Tiree** - comprising high density areas of inshore wintering waterfowl (Coll and Tiree, section 7.1.5). No overlap with seabird aggregations.
- **Sound of Gigha** - comprising high density areas of inshore wintering waterfowl (Sound of Gigha, section 7.1.5). No overlap with seabird aggregations.
- **Solway Firth** - comprising high density areas of inshore wintering waterfowl (Solway Firth, section 7.1.5). No overlap with seabird aggregations.

At this stage draft boundaries were drawn around the areas of highest densities for inshore wintering waterfowl and seabird aggregations.

[32] Further details on establishing high density areas and setting boundaries at sea are provided in the JNCC supplementary advice paper 'Defining SPA Boundaries At Sea'.

The predicted high density foraging areas identified for breeding terns were then considered. This identified one marine extension to an existing SPA for terns (**Ythan Estuary, Sands of Forvie and Meikle Loch SPA)** and overlaps with some of the existing nine indicative SPAs, where terns could be included as qualifying species. Breeding terns were added to North Orkney (Rousay), Pentland Firth (Pentland Firth Island) and Firth of Forth and Tay Bay (Forth Islands and Imperial Dock Lock, Leith) (section 7.3.6). The draft boundaries of the existing indicative SPAs were revised to accommodate the full extent of the predicted high density foraging areas for the respective breeding tern species.

The final areas of marine bird interest to address were the predicted high density foraging areas for breeding red-throated diver and the tracking data for breeding European shag. For breeding red-throated diver, this identified one indicative SPA (**Fetlar**) and overlaps with some of the existing indicative SPAs where red-throated diver could be included as qualifying species. Breeding red-throated diver was added to East Coast Mainland, Shetland (Dales Voe), North Orkney (North Orkney), Scapa Flow (Scapa Flow) and West Coast of the Outer Hebrides (West Coast of the Outer Hebrides) (section 7.4.5). In addition, the high density foraging area at Rum overlapped with the existing SPA marine extension (for Manx shearwater) so red-throated diver was added as an additional qualifying species to **Rum SPA**.

For breeding European shag, the predicted foraging area from the Isle of May colony overlapped with the Firth of Forth and Tay Bay (Firth of Forth, section 7.5.4). Breeding European shag was added as an additional qualifying species. No boundaries changes were made to the indicative SPAs as a result of the inclusion of breeding red-throated diver and European shag to the network.

The final network of 14 draft SPAs were submitted to Marine Scotland in June 2014. This included two offshore draft SPAs at Seas off Foula and Seas off St Kilda selected by JNCC (Figure 14). The proposed boundaries and qualifying features for each draft SPA were published by SNH and JNCC in a ‘Release Pack’. The inshore draft SPAs and their respective marine bird interests are summarised in Table 12.

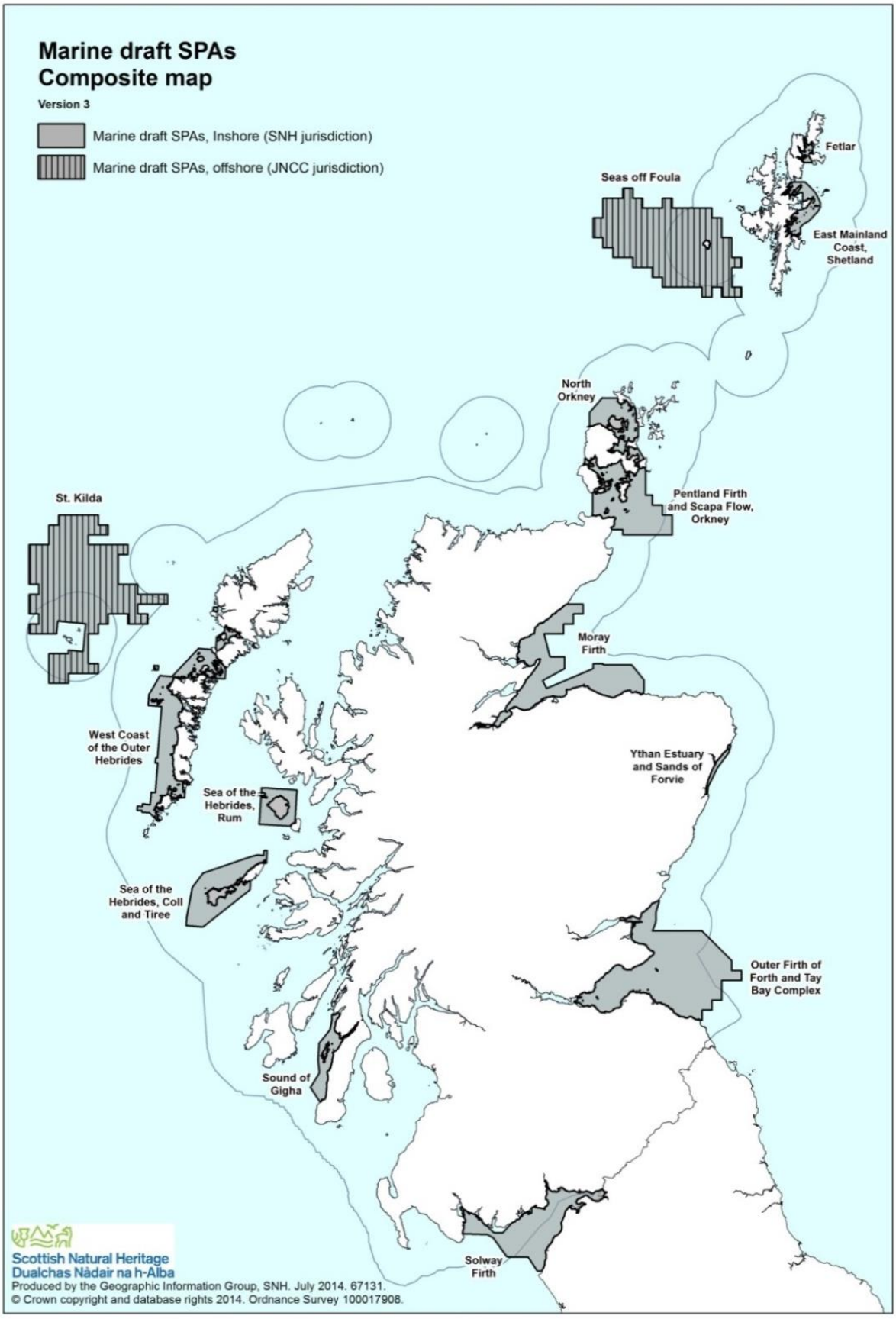

Figure 14: Network of marine draft SPAs as published by SNH and JNCC, 2014

Table 12: Draft SPAs with combined inshore areas identified for individual species

Breeding (br), non-breeding (nbr)

Marine bird interest/ draft SPA	**Inshore wintering waterfowl** (all species nbr)	**Seabird aggregations**	**Foraging areas for breeding terns**	**Foraging areas for breeding red-throated diver**	**Important areas for European shag**	**Roosting sites for wintering gulls**
Fetlar				Red-throated diver (Stage 1.1)		
East Coast Mainland, Shetland	Great northern diver (Stage 1.1). Common eider (Stage 1.2). Long-tailed duck & Red-breasted merganser (Stage 1.4)			Red-throated diver (Stage 1.1)		
North Orkney	Great northern diver & Slavonian grebe (Stage 1.1). Common eider, Long-tailed duck, Velvet scoter, Red-breasted merganser & European shag (Stage 1.4)		Arctic tern (Stage 1.1)	Red-throated diver (Stage 1.1)	European shag (nbr) (Stage 1.4)*	
Pentland Firth and Scapa Flow	Great northern diver, black-throated diver & Slavonian grebe (Stage 1.1). European shag (Stage 1.2). Common eider, Long-tailed duck, Common goldeneye, Red-breasted	Common guillemot (Stage 1.4)	Arctic tern (Stage 1.1)	Red-throated diver (Stage 1.1)	European shag (nbr) (Stage 1.2)*	

	merganser & European shag (Stage 1.4)					
Moray Firth	Great northern diver, red-throated diver & Slavonian grebe (Stage 1.1). Common eider, Long-tailed duck, Common goldeneye, Greater scaup, Common scoter, Velvet scoter & Red-breasted merganser (Stage 1.4)	European shag (Stage 1.2 (br & nbr)).			European shag (br & nbr) (Stage 1.2)**	
Ythan Estuary, Sands of Forvie and Meikle Loch SPA			Sandwich tern & little tern (Stage 1.1)			
Firth of Forth and Tay Bay Complex	Red-throated diver, Slavonian grebe & little gull (Stage 1.1). Common eider (Stage 1.2). Non-breeding waterfowl assemblage 1.3)	Atlantic puffin (br), Northern gannet (br)(Stage 1.2). Breeding seabird assemblage (Stage 1.3) Non-breeding seabird assemblage (Stage 1.3)	Arctic tern & common tern (Stage 1.1)		European shag (br) (Stage 1.2) European shag (nbr) (Stage 1.3)**	Non-breeding seabird assemblage (black-headed gull, common gull & herring gull (Stage 1.3))
West Coast of the Outer Hebrides	Great northern diver, black-throated diver & Slavonian grebe (Stage 1.1). Common eider, Long-tailed duck &			Red-throated diver (Stage 1.1)		

	Red-breasted merganser (Stage 1.4)					
Rum SPA				Red-throated diver (Stage 1.1)		
Coll and Tiree	Great northern diver (Stage 1.1). Common eider (Stage 1.4).					
Sound of Gigha	Great northern diver (Stage 1.1). Common eider & Red-breasted merganser (Stage 1.4).					
Solway Firth	Red-throated diver (Stage 1.1). Common scoter (Stage 1.4)					Non-breeding waterbird assemblage (black-headed gull, common gull & herring gull (Stage 1.3))

* Identified through the inshore wintering waterfowl survey programme
** Identified through the ESAs analysis

9 Pre-consultation revisions to the marine draft SPAs (2014-2016)

During the preparation for the consultation and as a direct result of pre-consultation discussions a number of changes were made to the network of draft SPAs before finalising these as proposed SPAs. This included some administrative changes such as site name changes as well as boundary changes and revisions of qualifying features.

9.1 Site name changes

Fetlar draft SPA was renamed to Bluemull and Colgrave Sounds proposed SPA to avoid confusion with the existing Fetlar SPA and to better reflect the marine waters the proposed site covers.

Firth of Forth and Tay Bay Complex draft SPA was renamed to Outer Firth of Forth and St Andrews Bay Complex proposed SPA again to better reflect the marine waters the proposed site covers.

9.2 Review of tern population estimates

Early in the pre-consultation stage, concerns were raised about the use of tern colony SPA citation populations as a basis for the draft SPAs population estimates, particularly with respect to known declines in populations and the ephemeral nature of terns. SNH therefore carried out a review of SPA colony tern numbers over the previous ten years (2004-14, data for 2015 was not available for all sites at the time of the review) to check the current status of the colonies. This revealed that the number of Arctic tern at Rousay (the breeding colony used to predict high density foraging areas for the North Orkney draft SPA) had declined significantly. Using the 10 year mean, the Rousay population was calculated at 99 pairs (0.2% UK population) and fell well below the 1% GB population threshold required to meet the UK SPA Selection guidelines for an Annex 1 species.

Whilst the population on Rousay has the potential to recover, we considered that the most recent data on population size at the breeding colony no longer supported the inclusion of marine waters around Rousay as being one of the most suitable territories for foraging Arctic tern. Arctic tern was therefore removed as a qualifying feature of the North Orkney draft SPA and the proposed boundary revised to exclude the predicted high density foraging area for Arctic tern. This revision was approved by SNHs' Scientific Advisory Committee MPA sub-group.

The revised boundary for the North Orkney was therefore based on the high density areas for inshore wintering waterfowl (Figure 15).

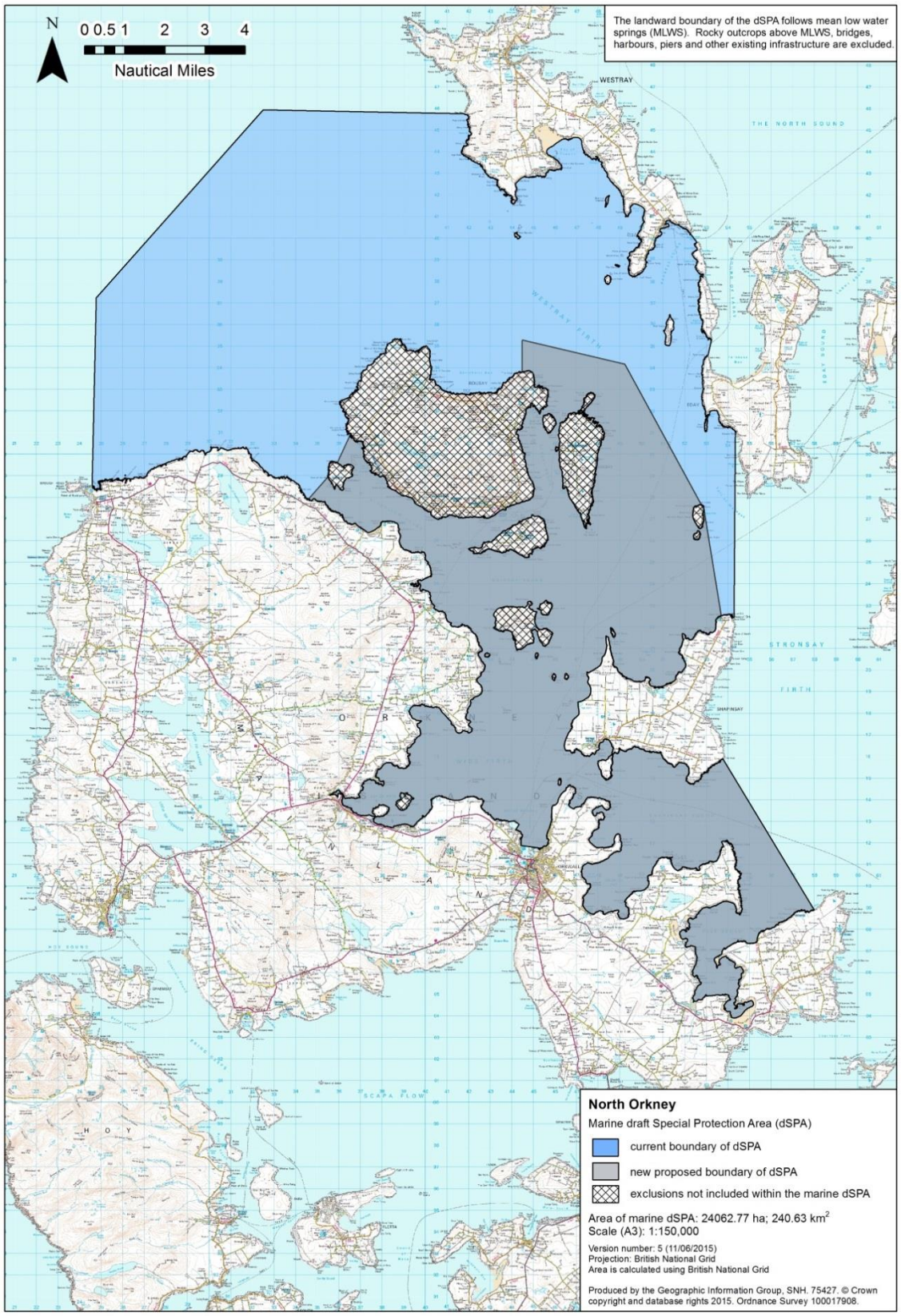

Figure 15: Revised proposed boundary of North Orkney after the removal of Arctic tern as a qualifying feature.

9.3 Marine SPA stakeholder workshop

In March 2016, Marine Scotland hosted a 'Marine SPA stakeholder workshop'. The outcomes of the workshop are presented in the workshop report. As a direct result of feedback from stakeholders attending the workshop two outcomes resulted in significant changes to the network of draft SPAs that were implemented as part of the final preparations for the proposed SPAs that were subsequently formally consulted on.

9.3.1 Refining SPA boundaries

Stakeholders requested that the proposed boundaries were refined to align more closely with the high density areas for each qualifying feature. This approach has been applied consistently across all of the proposals with boundary changes made to all the draft SPAs, except the existing Rum SPA boundary. Minor boundary amendments were also made to reflect the principles outlined in the workshop report on boundary setting around infrastructure.

The steps involved in preparing the boundaries for the proposed SPAs are illustrated in Figure 16 (example provided is the East Coast Mainland, Shetland proposed SPA which has no qualifying seabird aggregation or tern interest) and summarised below:

Step1 and 2: Overlay the high density areas for species qualifying under Stage 1.1, 1.2 or 1.3 with any species distribution maps of species qualifying under Stage 1.4 (see section 7.1.4).

Step 3: Prepare an indicative boundary for the draft SPA around high density areas for inshore wintering waterfowl [and seabird aggregations and predicted high density foraging areas for breeding tern]. The principle applied at the draft stage concentrated on preparing a simple boundary with as few vertices as possible to avoid overly complex boundaries.

Step 4: Identify overlapping predicted high density foraging areas for breeding red-throated diver that fall within the indicative boundary.

Step 5: Refine the proposed boundary of the draft SPA to align more closely to the high density areas.

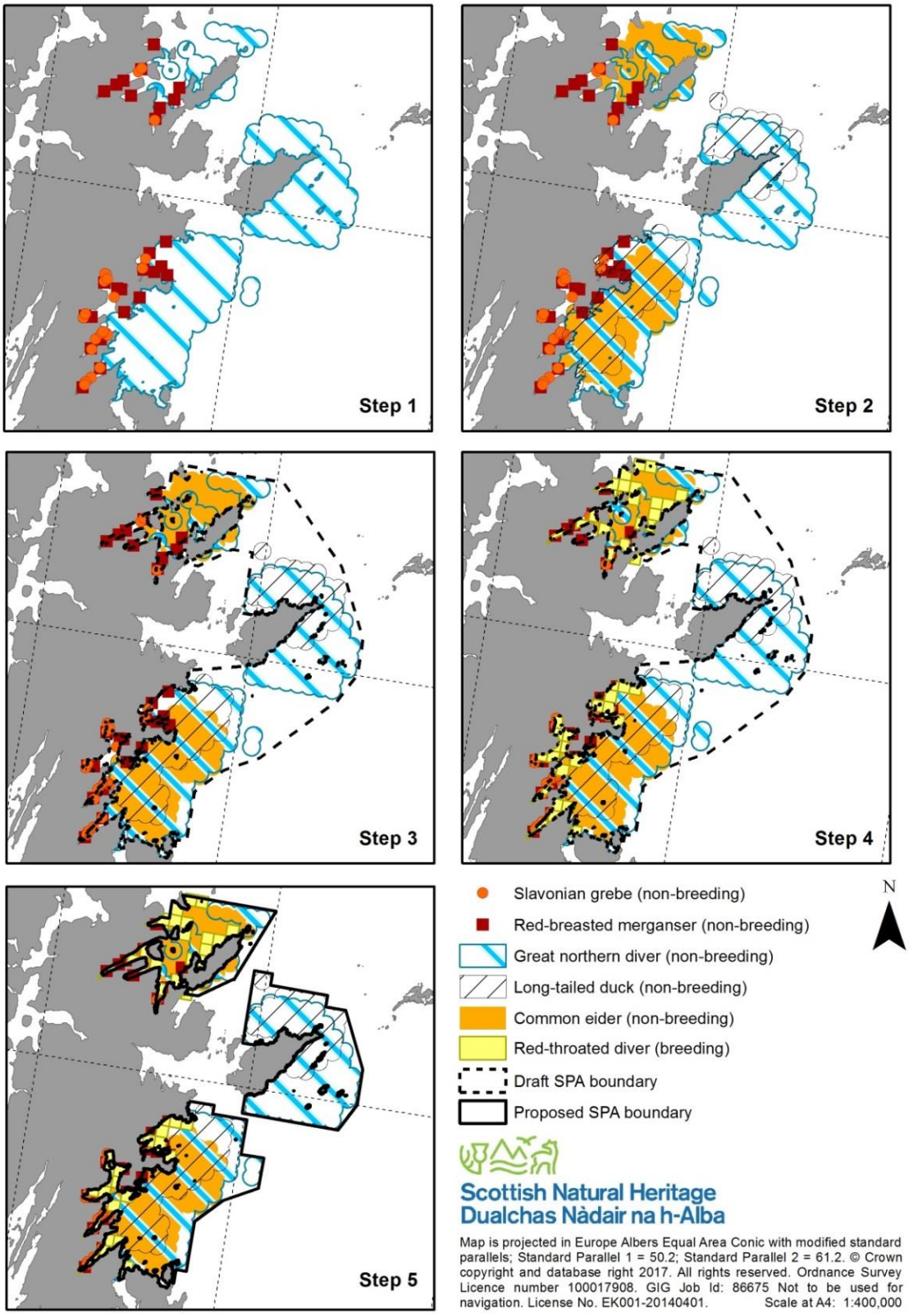

Figure 16: Finalising the proposed SPA boundaries

9.3.2 Recalculating population estimates within the new proposed SPA boundary

In the process of revising the proposed boundaries and changing the overall area of each site, there was the potential to change the size of the population estimates for each species within the new proposed SPA boundary. We expected that because the boundaries for these sites were reduced, then the population estimates for species within the site boundary would decrease and this may affect the qualifying status of some species. JNCC therefore recalculated the population estimates for each species within each proposed SPA and SNH reviewed the new population estimates against the Stage 1 UK SPA Selection guidelines.

The population estimates for the proposed SPAs were calculated in exactly the same way as they had been for the draft SPAs. For inshore wintering waterfowl, the density surfaces generated for each individual species and survey were used to estimate population sizes within a boundary. For each density surface i.e. each survey, the densities of all 1 km x 1 km grid cells that had their centre within the boundary were summed. This provides a population estimate within the boundary for that survey. The mean of peak population estimates within the boundary were then calculated from these estimates.

Seabird distributions were mapped on a large grid net around the UK. To determine the population within a proposed SPA boundary, ArcGIS was used to calculate the area [km^2] of each grid cell (6 km x 6 km), or partial cell, located within the boundary. For each cell the total number of individuals for each species was then estimated by multiplying the cell area with the species densities within each individual cell. The total of individuals for each species within the new boundary was provided by summing all cell totals within the boundary by species and season.

For terns, as mentioned in section 7.3.1, the cited colony SPA population estimates were used by SNH to provide the population estimates for the foraging areas. So there was no recalculation of tern population estimates required.

Breeding red-throated diver population estimates were based on the number of nest locations within foraging range (10km radius) of any part of the proposed marine SPA (nest locations based on a combination of Dillon et al., 2009 and most recent BTO breeding bird atlas, with ‘double counts’ removed).

This review of population estimates by SNH against the Stage 1 guidelines confirmed that despite a slight reduction in population estimates for some species, in all but two proposed SPAs the qualifying species remained unchanged. When reviewing the seabird assemblages it highlighted that there were additional species of seabirds that should be considered as named qualifiers of the seabird assemblage (Stage 1.3[33]) for two areas: the Outer Firth of Forth and St Andrews Bay Complex, and the Pentland Firth. Further details on these changes are provided in section 9.3.3 and 9.3.4.

The recalculated population estimates provided the final population estimates presented in the Site Selection Documents and were approved by SNH’s Scientific Advisory Committee MPA sub-group, SNH Board’s Protected Areas Committee and JNCC’s MPA sub-group.

9.3.3 Pentland Firth and Scapa Flow draft SPA

In response to a specific request from the stakeholders’ workshop, SNH considered a proposal to split the Pentland Firth and Scapa Flow draft SPA into two sites. Stakeholders highlighted that there was not a significant overlap in distributions of breeding common

[33] The area is used regularly by over 20,000 waterbirds (waterbirds as defined by the Ramsar Convention) or 20,000 seabirds in any season.

guillemot and Arctic tern in the Pentland Firth with species largely confined to Scapa Flow and that making this separation would help focus management.

SNH prepared two new site boundaries, one based on non-breeding waterfowl high density areas (and including non-breeding European shag and the predicted high density foraging areas for breeding red-throated divers) and the other on the breeding seabirds (common guillemot high density area and the predicted high density foraging areas for Arctic tern) (Figure 17).

The change in size of the two new proposed SPAs required all species population estimates to be recalculated by JNCC and subsequent confirmation by SNH that species within each of the new proposed SPAs met the Stage 1 guidelines:

Scapa Flow proposed SPA

The following species, which qualified in the Pentland Firth and Scapa Flow draft SPA under guidelines 1.1, 1.2 or 1.4 were re-assessed by SNH:

- Great northern diver (non-breeding)
- Red-throated diver (breeding)
- Black-throated diver (non-breeding)
- Slavonian grebe (non-breeding)
- European shag (non-breeding)
- Common eider (non-breeding)
- Long-tailed duck (non-breeding)
- Common goldeneye (non-breeding)
- Red-breasted merganser (non-breeding)

The distributions of these species are largely confined to the enclosed sea area of Scapa Flow. Therefore the population estimates for each species are based almost entirely on the Scapa Flow Area of Search (section 7.1) and consequently, population estimates for all species of inshore wintering waterfowl have not changed as a result of the boundary change. The new SPA boundary did result in a reduction of the predicted number of breeding red-throated diver (from 97 pairs to 81 pairs) within foraging range of the proposed SPA. However, the revised population estimate still exceeded the required population threshold for qualifying under Stage 1.1, with the proposed SPA supporting 7.6% of the GB population. All species therefore continue to qualify in accordance with their original Stage 1 and Stage 2 SPA selection assessments.

One of the artefacts of splitting the Pentland Firth and Scapa Flow draft SPA was that the full extent of the high density areas of two species qualifying under Stage 1.4 (common eider and long-tailed duck) no longer overlapped with species qualifying under Stage 1.1 or 1.2. The decision to retain the full extent of the high density areas for these species in Scapa Flow pSPA was based on there being an overlap with qualifying species of the Pentland Firth proposed SPA. SNH also concluded that the proposal to split the Pentland Firth and Scapa Flow draft SPA to assist with management decisions should not compromise the qualifying species.

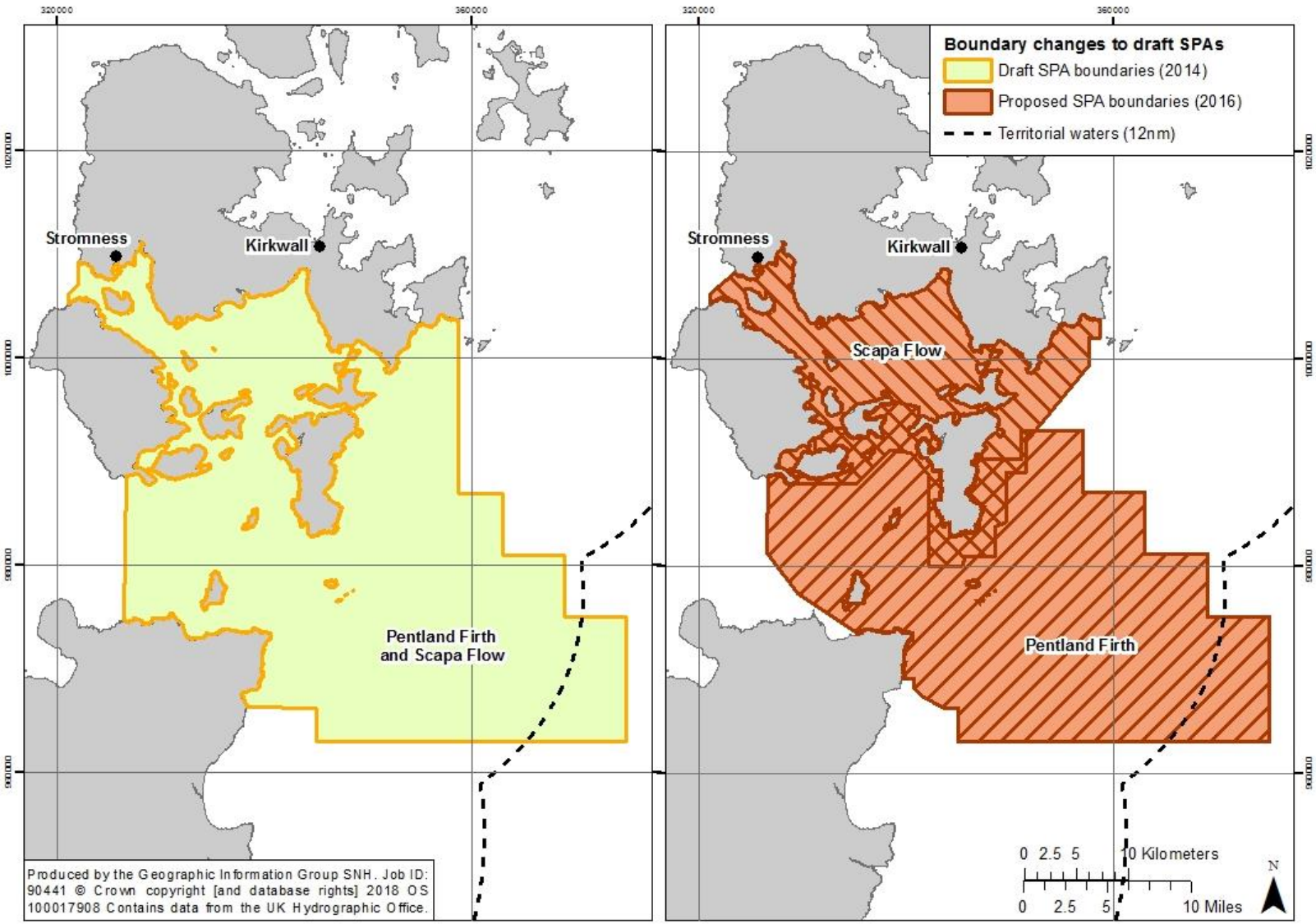

Figure 17: Revision of the Pentland Firth and Scapa Flow site boundaries

Pentland Firth proposed SPA

The following species, which qualified in the Pentland Firth and Scapa Flow draft SPA under guidelines 1.1 and 1.4 were re-assessed by SNH:

- Arctic tern (breeding)
- Common guillemot (breeding)

The distributions of these species are largely confined to the Pentland Firth. The population estimate for Arctic tern at the new site remains unchanged as this is based on the Pentland Firth Islands SPA population at classification (1995). Numbers at the colonies have been confirmed as still regularly supporting over 1% of GB population (2015).

The re-calculated population estimate for common guillemot within the new site boundary showed a reduction in numbers (from 36,530 to 34,410 individuals) which reflects the smaller area of the proposed site.

Re-assessment of the population estimates against the Stage 1 guidelines highlighted that the new focus on breeding seabirds within the Pentland Firth also lent itself to qualifying under the Stage 1.3 guidelines for a breeding seabird assemblage. The JNCC recalculation of the population estimates (section 9.3.2) within the Pentland Firth proposed SPA boundary confirmed a breeding seabird assemblage of over 41,000 birds with Arctic tern[34], common guillemot and Arctic skua all occurring in numbers exceeding 1% of the GB population (Table 13). Arctic tern continued to qualify under Stage 1.1 with common guillemot and Arctic skua qualifying as named qualifier of the breeding seabird assemblage (section 6.3). Although no high density area was identified for Arctic skua these birds are likely to be associated with breeding populations in Caithness and Orkney.

Table 13: Breeding seabird assemblage population estimates for the Pentland Firth proposed SPA

Feature	**Pentland Firth population estimate (individuals)**	**National population[2]**	**2000 individuals**	**Qualifying status**
Breeding seabird assemblage (existing feature of dSPA)	41,181[35]	n/a	n/a	>20,000 individuals & therefore qualifies (Stage 1.3)
Arctic tern	1,000	2%	n/a	Qualified under Stage 1.1
Common guillemot	34,410	2%	>2,000	Named qualifier as part of a breeding seabird assemblage (Stage 1.3)
Arctic skua	75	1.2%	<2,000	Named qualifier as part of a breeding seabird assemblage (Stage 1.3)

The revised boundaries, population estimates and assessments against the Stage 1 guidelines were reviewed and approved by SNH Scientific Advisory Committee's MPA Sub-group.

[34] Colony counts at classification used for population estimates not ESAS
[35] Includes all breeding species

New Site Selection Documents were prepared for the Scapa Flow proposed SPA and Pentland Firth proposed SPA and submitted to Marine Scotland in June 2016.

9.3.4 Outer Firth of Forth and St Andrews Bay Complex proposed SPA: revisions to seabird assemblages

For the Outer Firth of Forth and St Andrews Bay Complex proposed SPA the recalculation of the population estimates for breeding and non-breeding seabirds identified some changes in composition of named qualifiers within the respective seabird assemblages.

The reduced number of breeding razorbill within the new proposed boundary fell below the minimum requirements of 1% of the GB population or 2,000 individuals and therefore could no longer be considered as a named qualifier of the breeding seabird assemblage. The recalculations also highlighted that breeding herring gull qualified as a named qualifier of the breeding seabird assemblage and non-breeding razorbill, European shag and black-legged kittiwake met the required population thresholds to be considered as named qualifiers of the non-breeding seabird assemblage (Table 14). These revisions to the composition of the seabird assemblage were reviewed and approved by SNH Scientific Advisory Committee's MPA Sub-group.

Table 14: Outer Firth of Forth and St Andrews Bay Complex draft SPA (OFofF) seabird assemblages

Feature	OFoF population estimate (individuals)	National population[36]	2000 individuals	Seabird assemblage
Breeding seabird assemblage	101,618	n/a	n/a	>20,000 individuals – existing feature
Non-breeding seabird assemblage	44,628	n/a	n/a	>20,000 individuals – existing feature
Razorbill (breeding) (existing feature)	1,868	<1% (3,300)	<2,000	No longer qualifies
Herring gull (breeding)	3,044	<1% (3,900)	>2,000	Named qualifier as part of a breeding seabird assemblage
Razorbill (non-breeding)	5,481	Not known	>2,000	Named qualifier as part of a non-breeding seabird assemblage.
European shag (non-breeding)	2,426	>1% (1,100)	>2,000	Named qualifier as part of a non-breeding seabird assemblage.
Kittiwake (non-breeding)	3,191	Not known	>2,000	Named qualifier as part of a non-breeding seabird assemblage.

[36] National reference populations are taken from Musgrove *et al* 2013. Breeding pairs are multiplied by three to provide an estimate for individuals including associated immature/non-breeders in the population.

The Site Selection Document for the Outer Firth of Forth and St Andrews Bay Complex proposed SPA was revised to reflect the changes in the species composition of the breeding and non-breeding seabird assemblages.

10 Final network of marine proposed SPA

The final network of fifteen marine proposed SPAs was submitted to Marine Scotland in June 2016 (Figure 18). Scottish Ministers approved the case for consultation on the ten proposed SPAs occurring entirely in Scottish territorial water in July 2016 with UK and Scottish government approving consultation on the remaining five proposed SPA in October 2016.

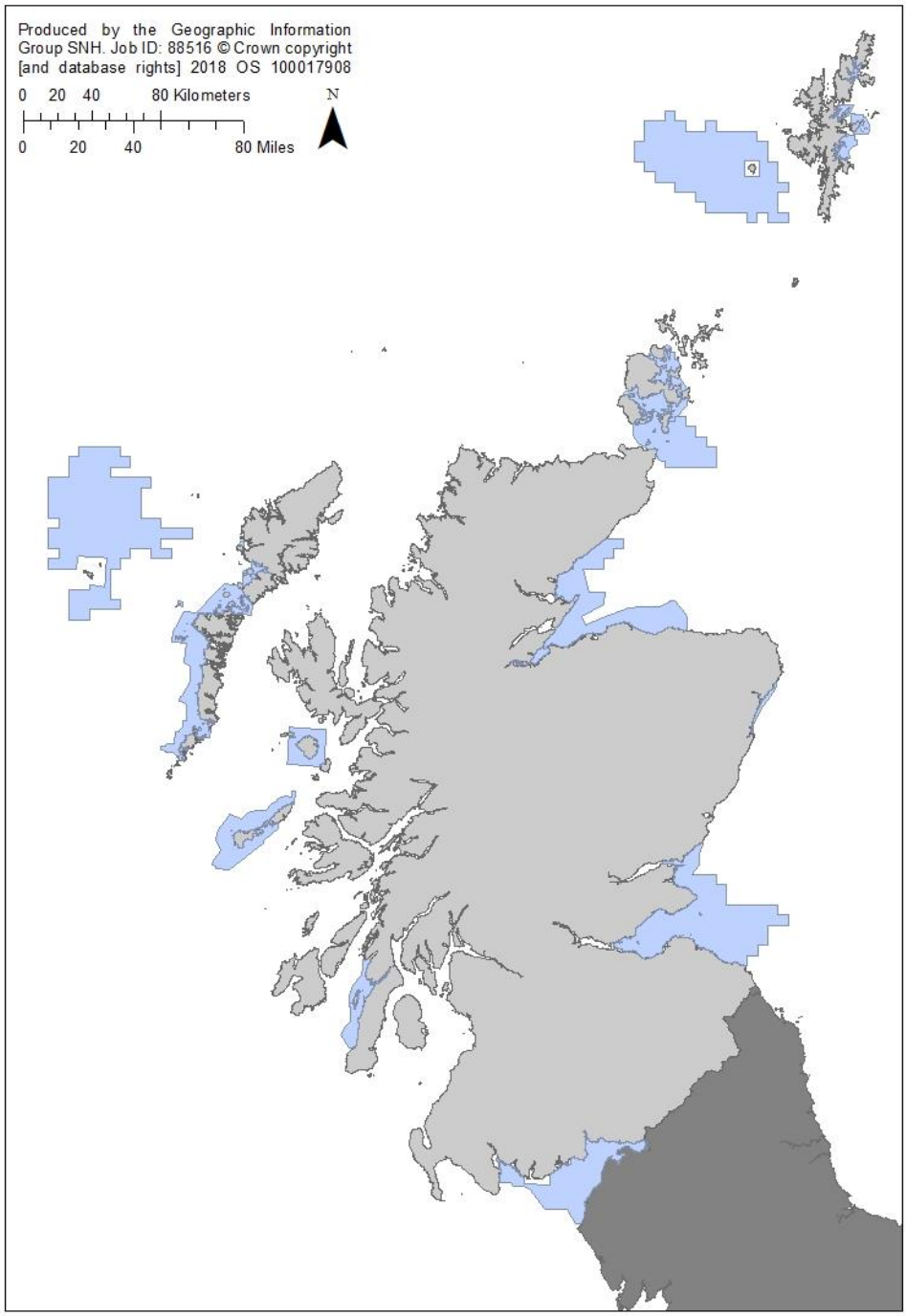

Figure 18: Final network of marine proposed SPAs

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Annex 1: Conservation benefits of site protection[37]

Migratory species	Conservation benefits of site protection
Waterfowl	
Divers (red-throated diver, great northern diver and black-throated diver) (non-breeding)	All three of these wintering diver species exhibit high or very high sensitivity to vessel movements (Jarrett *et al.*, 2018) with associated vulnerability to displacement from development areas such as marine wind farms (Furness *et al.*, 2013). They are also vulnerable to entanglement in fishing gears (Furness, 2016; Bradbury *et al* 2017). Site-based protection of marine areas in Scotland holding regularly occurring notable aggregations of these species in the non-breeding season enables targeted management of these pressures in those areas that will make the greatest contribution to the safeguard of the relevant populations. For great northern diver, this includes a high proportion of the biogeographic breeding population, including birds from Iceland and Greenland. There is also strong evidence of winter site fidelity in great northern diver with birds returning to the same area from one winter to the next (Heubeck, 1997; Pennington *et al*, 2004; Jardine & Fisher, 2015; Paruk *et al*, 2015). Wintering populations of red-throated diver in Scotland are of particular importance to the GB (Scottish) breeding population of c.1,300 pairs (Furness, 2015). The very small breeding population (190 -250 pairs) of black-throated diver in GB (Scotland) are also believed to winter here.
Slavonian grebe (non-breeding)	Slavonian grebe winter in shallow coastal waters close to shore. This species shows very high sensitivity to vessel movements (Mendel *et al*, 2008; Jarrett *et al* 2018) and is assessed as vulnerable to disturbance and changes in water clarity associated with aggregate extraction or dredging (Cook & Burton, 2010). Slavonian grebe are also susceptible to entanglement in fishing nets (Mendel *et al* 2008). Site-based protection of marine areas in Scotland holding regularly occurring notable aggregations of Slavonian grebe in the non-breeding season enables targeted management of these pressures in those areas that will make the greatest contribution to the safeguard of the relevant populations. Some 20% of the small (4,600 – 6,800 birds) biogeographic (North-west Europe (large-billed)) population winter in GB (Wetlands International, 2015) with the main concentrations restricted to Scotland.
Seaduck (non-breeding)	These four species of seaduck feed predominantly in winter on bivalves (Woodward & Humphries,

[37] Notes on conservation benefits are only provided for species included in the proposed SPA network.

largely dependent upon bivalves: common eider, velvet scoter, common scoter, greater scaup (non-breeding)	2018). Eider are commonly associated with blue mussel beds on rocky substrates in shallow waters (*ibid*). Common and velvet scoter form very dense aggregations over soft substrates where they feed on species such as cockles and clams (*ibid*). Greater scaup are largely nocturnal when feeding. They forage predominantly on bivalves where these are abundant in shallow waters but will also take other prey including gastropods and waste grain from sewage outflows (*ibid*). Common scoter, eider and greater scaup are vulnerable to changes in availability of favoured bivalve prey (Mendel *et al*, 2008). Both species of scoter, particularly common, are sensitive to visual disturbance associated with vessel movements and are vulnerable to displacement from development areas such as marine wind farms (Furness *et al*, 2013). Greater scaup also show sensitivity to visual disturbance associated with vessel movements in near-shore daytime roost sites (Mendel *et al* 2008) but the potential significance of such disturbance in nocturnal feeding grounds is unknown (Platteeuw & Beekman, 1994). Eider show moderate sensitivity to visual disturbance (Jarrett *et al*, 2018). All four species are particularly vulnerable to disturbance, and to oil spills, during their flightless moult periods and are also susceptible to entanglement in set fishing nets (Mendel *et al*, 2008; Bradbury *et al* 2017; Žydelis *et al* 2013). Eider may also come into direct conflict with shellfish farmers (Waltho & Coulson, 2015). The dependence of these species on accessible benthic habitats supporting high densities of preferred prey is reflected in their flocking behaviour. In addition, all show moderate to high sensitivity to human activity at sea. Site-based protection of major aggregations of these birds and of the habitats supporting their prey is the most effective approach to the safeguard of relevant populations. In the case of the *faeroeensis* race of eider, the Shetland population represents 100% of the biogeographic (*faeroeensis*, Shetland, Orkney Is) and 31-48% of the S. m. *faeroeensis* subspecies, which also includes birds from the Faeroe Islands (Wetlands International 2018).
Other sea ducks (long-tailed duck, and common goldeneye) (non-breeding)	Long-tailed duck feed on a wide range of suitably sized prey including bivalves, gastropods, crustacea, amphipods and fish which may be taken in shallow near-shore waters or in deeper waters (up to 50m) further offshore (Woodward & Humphries, 2018). Goldeneye show even greater variability in diet but are restricted to very shallow waters often in estuaries (*ibid*). Long-tailed duck are highly sensitive to visual disturbance associated with vessel movements (Jarrett *et al,* 2018) and barrier effects and habitat loss have been documented at offshore wind farms in Sweden and Denmark (Dierschke & Garthe, 2006). Both species have been recorded as bycatch in set nets in the Baltic (Hearn *et al* 2015; Mendel *et al* 2008; ICES, 2013) but there is no evidence of population level

	impacts and vulnerability to bycatch in British fisheries appears low (Bradbury *et al*, 2017). Common goldeneye are a legal quarry species in GB, but in the absence of data on numbers of birds killed annually it is not possible to assess the extent to which legal shooting may contribute to the current population decline (Furness, 2016). In addition, both long-tailed duck and common goldeneye have been identified as vulnerable to impacts of climate change with potential for moderate magnitude declines in the UK (Pearce-Higgins *et al*, 2011) and significant north-easterly shifts in the wintering range of common goldeneye in NW Europe over the past three decades (Lehikoinen et al 2013). Site-based protection of areas used regularly by large aggregations of long-tailed duck is recognised internationally as an appropriate conservation measure to enhance resilience to anthropogenic threats and pressures (Hearn *et al*, 2015). Well-managed protected sites are also important to promoting the resilience of species and habitats to the impacts of climate change (SNH 2016). Site-based protection of marine areas used by notable aggregations of long-tailed duck and common goldeneye, including in sites contiguous with existing estuarine SPAs, will contribute to conservation of European breeding populations by ensuring protection of the full range of winter supporting habitats for these species in Scotland.
Sawbills (red-breasted merganser and goosander) (non-breeding)	Red-breasted merganser and goosander feed on small fish, which they pursue in shallow waters (Woodward & Humphreys, 2018). Goosander is primarily a freshwater species and marine distribution in Scotland is largely confined to estuaries and adjacent waters. Red-breasted mergansers are more widely distributed in shallow near-shore waters along both estuarine and non-estuarine coasts. Red-breasted mergansers appear more sensitive than other waterfowl to sudden loud noise and exhibit very high sensitivity to vessel movements (Jarrett *et al*, 2018; Mendel *et al* 2008); information is lacking for goosander. Both species have been reported as bycatch in set net fisheries (ICES, 2013; Mendel *et al* 2008; Žydelis *et al*, 2013) but there is no evidence of population level impacts. Goosanders wintering in the UK have been assessed as vulnerable to moderate magnitude declines driven by climate change (Pearce-Higgins *et al*, 2011) and significant north-easterly shifts in the wintering range of goosander in NW Europe over the past three decades are attributed to climate change (Lehikoinen *et al* 2013). Apparent shifts in wintering range of red-breasted merganser may also potentially be linked to climate change (Holt *et al*, 2011). Site-based protection of marine areas in Scotland holding regularly occurring notable aggregations of these species in the non-breeding season enables targeted management of localised pressures, such as vessel movements. Well-managed protected sites are also important to promoting the resilience of species and habitats to the impacts of climate change (SNH 2016). Site-based protection of notable

	aggregations of these species in shallow marine waters, including in areas contiguous with existing estuarine SPAs, will contribute to safeguard of relevant breeding populations. For red-breasted merganser, the birds wintering in GB include the majority of the Icelandic breeding population as well as British birds (Wernham *et al*, 2002, Wright *et al* 2012).
Seabirds	
Shearwaters, petrels and fulmar (Manx shearwater - breeding, European storm petrel – breeding and northern fulmar – breeding and non-breeding)	Fulmar, Manx shearwater and European storm petrel are wide-ranging pelagic species feeding in surface waters. In 1998-2002, Scotland held up to 39% of the world breeding population of Manx shearwater and up to 16.5% and 9% respectively of the relevant biogeographic breeding populations of northern fulmar and European storm petrel (Mitchell *et al*, 2004). In the non-breeding season, some 12% of the biogeographic population of northern fulmar are estimated to use Scottish waters (Forrester et al 2007; Furness 2015) European storm-petrels and Manx shearwaters are highly vulnerable to depredation by introduced mammalian predators at their breeding (Furness, 2016). At sea, shearwaters and fulmars are particularly vulnerable to bycatch in longline fisheries (Cortes *et al*, 2018; Tasker *et al*, 2000; Žydelis *et al*, 2013; Dunn & Steel 2001, ICES 2013) but there is no empirical data on actual capture rates or impacts on populations in UK waters (Bradbury *et al*, 2017). Northern fulmar prey extensively on fisheries waste (Phillips *et al*, 1999) and may be affected by changes to fisheries management aimed at reducing levels of fisheries discards (Bicknell *et al* 2013). Examination of fulmar corpses indicates high levels of plastic ingestion but population level impacts are currently unclear (Franeker *et al* 2011, Provencher *et al* 2014). Reductions in sandeel abundance and changes to plankton communities, probably caused by increases in sea surface temperature, are also likely to be responsible for recent declines in fulmar breeding populations and the species is identified as sensitive to climate change (Thompson & Ollason 2001) with breeding populations likely to suffer moderate or high magnitude declines in response to climate change over the next 40 years under a medium emissions scenario (Pearce-Higgins *et al* 2011). The potential impacts of climate change on European storm-petrel and Manx shearwater in the UK are unclear (Pearce-Higgins *et al* 2011; Russell *et al*, 2015; Thompson & Furness, 1991) Safeguard of breeding populations of these wide-ranging pelagic species requires measures to protect breeding sites from introduction of mammalian predators and wider seas approaches to management of

	potential threats and pressures (such as plastic ingestion, fisheries bycatch and climate change) operating at an ecosystem or broader scale (Furness, 2016). The wide-ranging, dispersed and unpredictable marine distribution of these species also limits potential for identification of regularly occurring hotspots of activity at sea (Kober *et al*, 2010). However, site-based protection of those few marine areas used regularly by large aggregations of these birds is a complementary measure that may enhance resilience to such threats and pressures by safeguarding important foraging habitats and prey species. The marine pSPAs for breeding northern fulmar and European storm petrel are also functionally linked to existing colony SPAs for these species.
Northern gannet (breeding)	The Scottish breeding population of northern gannet represents 58.4% of the biogeographic population (Murray *et al* 2015) and breeding gannets from Scottish colonies forage widely across Scotland's seas. Outwith the breeding season, it is estimated that less than 1% of the gannets overwintering in or moving through UK waters are found in Scotland (Forrester *et al* 2007; Furness 2015). Northern gannet populations may be impacted by mortality as a result of collision with offshore wind farm turbines (Furness *et al* 2013, ICES 2015). Northern gannets are also identified as among the most potentially vulnerable species to bycatch in both surface and pelagic gears in UK waters (Bradbury *et a*l, 2017) and may also potentially be affected by changes to discarding practices in commercial fisheries (Bicknell *et al*, 2013). Northern gannets can travel great distances from their nest site to forage and are able to exploit a wide range of prey. Hence, they may have greater potential than some other seabird species to adapt to climate change, although there is no clear consensus on this (Huntley *et al,* 2007; Pearce-Higgins *et al* 2011). Site-based protection of marine areas used regularly by large aggregations of breeding Northern gannets and encompassing supporting habitats (e.g. foraging locations) complements wider seas management measures. Site-based protection of such areas is considered an appropriate conservation measure to enhance resilience of northern gannet (breeding) to the varied threats and pressures to which it is susceptible. There are also clear functional linkages between the proposed marine SPAs for northern gannet in the Scottish network and existing colony SPAs (Wakefield *et al*, 2013).
European shag (breeding and non-breeding) and red-throated diver (breeding)	In the breeding season, both European shag and red-throated diver forage in relatively shallow inshore waters on fish such as sandeels within 10-15km of their breeding sites (Daunt *et al*, 2015; Bradbury *et al*, 2017; Black *et al*, 2015). In the winter, adult shags typically remain within 50km of their breeding site (Wernham *et al* 2002).

	The most recent (1998-2002) estimate of the Scottish breeding population of European shags represents some 30% of the relevant biogeographic population (Mitchell *et al* 2004) and 80-90% of the GB wintering population occur in Scotland (Furness 2015, Austin *et al* 2017). Scotland holds the entire GB population of breeding red-throated diver Dillon *et al*, 2009 Shags and divers are susceptible to fatal entanglement in various fishing gears (ICES, 2013 Tasker *et al* 2000, Dierschke *et al*, 2012, Zydelis *et al* 2013). European shag are identified as among the most potentially sensitive species to bycatch in surface gears, pelagic gears and at depth near the seabed in UK waters and red-throated divers may be moderately vulnerable to bycatch in surface gears (Bradbury *et al*, 2017). However, there is no systematic data from which to assess bycatch rates or impacts for either species (*ibid*). There is also potential for individual-level impacts on European shag (non-breeding) through collision with tidal-stream energy generating devices, but potential population-level impacts are currently unknown (Furness *et al* 2012). Red-throated divers exhibit very high sensitivity to visual disturbance associated with shipping or recreational craft (Mendel *et al* 2008; Dierschke *et al*, 2012; Jarrett *et al*, 2018) and visual disturbance as a result of vessel movements may negatively impact foraging behaviour of European shags (Cook and Burton 2010, Velando and Munilla 2011) European shag are susceptible to increased storminess (Bustnes *et al*, 2013; Frederiksen *et al,* 2008), and to indirect effects of climate change and breeding populations in the UK are predicted to suffer moderate or high magnitude declines in response to climate change over the next 40 years under a medium emissions scenario (Pearce-Higgins *et al* 2011). Breeding red-throated diver populations have been identified by several authors as subject to significant changes associated with climate change but the direction and magnitude of change is unclear (Pearce-Higgins *et al* 2011; Huntly *et al,* 2007). Site-based protection of inshore foraging areas used by notable aggregations of red-throated diver in the breeding season and by European shag in both breeding and non-breeding seasons is appropriate given susceptibility of these species to localised pressures such as disturbance and entanglement in static fishing gears. Site-based protection also enhances resilience of existing breeding site SPAs with functional linkages to the proposed marine SPAs for both species by safeguarding both marine habitats supporting key prey species and the birds' access to these prey. Well-managed protected sites for

	these species and their supporting habitats are also important to promoting resilience to the impacts of climate change (SNH 2016). Protected sites may also increase resilience of shag populations to sporadic winter population "wrecks" that may depress breeding populations over a number of subsequent years (Heubeck *et al*, 2015)
Skuas (great and Arctic)	Scotland has a particular responsibility for great skua as the breeding population represents 60.0% of the small biogeographic (World) population estimated at 16,000 pairs (Mitchell *et al* 2004). Both great and Arctic skua are vulnerable either directly or indirectly to reduced availability of sandeels (Furness and Tasker, 2000) and great skua are also susceptible to changes in fisheries management aimed at reducing levels of fisheries discards (Hamer *et al*, 1991, Votier *et al* 2004). Food availability also underpins complex interactions between these two species during the breeding season and great skua is a significant predator of Arctic skua chicks at some colonies (Meek *et al*, 2011; Caldow & Furness, 2000). Both species are also potentially vulnerable to collision with marine wind turbines (Furness *et al*, 2013) Marine protected areas for skuas will contribute to safeguard of marine habitats supporting prey species, such as sandeel, used by birds from existing colony SPAs in both the breeding and, for great skua, early/late non-breeding seasons. In addition, both great and Arctic skua are at the southern edge of their breeding range in northern Scotland and have been identified as being at risk of extinction as breeding species in Britain as a consequence of climate change (Russell *et al* 2015). Well-managed protected sites are important to promoting the resilience of species and habitats to the impacts of climate change (SNH 2016).
Foraging gulls that breed in Scotland (black-legged kittiwake – breeding and non-breeding and herring gull - breeding)	In 1998-2002, Scotland held c.10% of the relevant biogeographic breeding population of breeding populations of both black-legged kittiwake and herring gull (Mitchell *et al*, 2004). Black-legged kittiwakes tend to be pelagic during the non-breeding season (Forrester *et al* 2007, Frederiksen *et al* 2012) but significant numbers remain in coastal areas and North Sea (Bogdanova *et al* 2011; Frederiksen *et al* 2012). Herring gulls are among the seabird species assessed as most at risk of impacts through collision with offshore wind turbines (Furness *et al*, 2013; Johnston *et al*, 2014). Black-legged kittiwakes are also vulnerable to mortality as a result of collision with offshore wind farm developments as well as to displacement from foraging/commuting areas (Furness *et al* 2013). Depletion of prey resources, such as sandeels, by fishing activities is a known driver of black-legged

	kittiwake population declines (Frederiksen *et al* 2004) and they are also highly vulnerable to the impacts of climate change on the population dynamics and distribution of their preferred prey (Sandvik *et al*, 2014; Russell *et al*, 2015; Frederiksen *et al,* 2004). Herring gulls are highly diverse at both population and individual levels in their foraging strategies and extent of reliance on marine versus terrestrial food sources(Coulson, 2015; Rock *et al*, 2016) such that determining the main drivers of change at colony, regional or national levels is complex (Coulson, 2015). Some herring gull populations are vulnerable to reductions in availability of fisheries waste and/or discards (Mitchell *et al,* 2004; Dunn, 1997; Furness *et al*, 1992) but the potential impacts of climate change are uncertain. Changes in discard practices could also impact black-legged kittiwakes that forage in association with fishing vessels (Tasker *et al* 2000, Bicknell *et al* 2013). There are recorded incidences of gull entanglement in fishing gear, most likely during hauling (Žydelis *et al,* 2013) and gull species are also susceptible to bycatch in longline fisheries (ICES, 2013), but there is no empirical evidence of bycatch rates or impacts in UK waters (Bradbury *et al*, 2017). Site-based protection of areas regularly used by notable numbers of foraging gulls is appropriate to management of pressures such as risk of collision or displacement associated with offshore wind farms and is complementary to wider-seas measures, including fisheries management, required to address other anthropogenic pressures that operate at the wider ecosystem level. Well-managed protected sites are also important to promoting the resilience of vulnerable species, such as black-legged kittiwake, and their supporting marine habitats to the impacts of climate change (SNH 2016). There are also functional linkages between the proposed marine SPAs for both species in the Scottish network and existing SPAs for their breeding sites.
Roosting gulls (black-headed gull, common gull and herring gull) (non-breeding)	Black-headed and common gulls forage primarily in terrestrial and intertidal habitats, mainly using marine (and estuarine) areas as night-time roosts (Forrester *et al* 2007). Herring gulls also roost at sea and forage in terrestrial, intertidal and marine environments. At sea in winter foraging herring gulls show a strong association with the distribution of fishing vessels, congregating in areas where fisheries discards are available (Camphuysen *et al* 1995, Furness 2015). Overwintering gull populations in Scotland represent approximately 4%, 12% and 20-25% of the relevant European biogeographic populations of black-headed gull, common gull and herring gull respectively (Wetlands International 2015; Burton *et al* 2013). Common gulls wintering along the east coast include including a large influx into GB from continental Europe and Iceland (Forrester *et al* 2007, Burton *et al* 2013).

	There is evidence that offshore wind development is a threat to relevant populations of herring and black-headed gull (non-breeding) in UK waters, primarily as a result of potential collision with turbines; population level impacts on common gulls are unclear (Furness *et al* 2013, Furness 2016). Lower level threats for both black-headed and common gulls include accidental entanglement in fragments of fishing net and other plastic waste (Mendel *et al* 2008). Black-headed and herring gulls have also been identified as at risk of accidental bycatch in some fisheries (ICES 2013, Žydelis *et al*. 2013, Bradbury *et al*, 2017) and herring gulls may also be affected by changes to fisheries management aimed at reducing levels of fisheries discards (Dunn 1997, Bicknell *et al* 2013). The potential impacts of climate change on all three of these gull species in the UK are unclear. The SPAs for non-breeding gulls in Scotland are proposed primarily for night-time roosting areas. Site-based protection enables safeguard of these birds from incidental disturbance or displacement and is complementary to wider seas measures, including fisheries management, for safeguard of wintering populations of these species.
Little gull (non-breeding)	Small numbers of little gulls, estimated in the hundreds (Lack, 1986) overwinter in GB waters but as a result of their generally offshore nature, there is sparse information on little gull populations in GB and Scotland. There is no evidence of activities in UK waters generating pressures or threats likely to have high or medium impacts on relevant populations of little gull (non-breeding) (Furness, 2016). However, little gulls are potentially susceptible to collision with offshore wind turbines (Bradbury *et al* 2014), depletion of prey resources (Mendel *et al* 2008), habitat degradation, including changes in hydrographic conditions (Forrester *et al* 2007), oil spills (Mendel *et al*. 2008), and accidental bycatch in fishing gear (Žydelis *et al*. 2013, Bradbury *et al*, 2017). The potential impacts of climate change on little gull in the UK are unclear. The species has a very restricted distribution and only one hotspot holding qualifying numbers (50 or more) little gull (non-breeding) has been identified in Scotland's seas (Kober *et al*, 2010; Lawson *et al*, 2015; Bradbury *et al*, 2017).
Terns (Arctic, common, Sandwich and little) (breeding)	Terns are dependent for successful chick-rearing upon access to plentiful stocks of energy-rich small fish in the vicinity of their breeding colonies. Foraging ranges extend to 30-50km for Sandwich tern, 25-30km for Arctic tern, 15-20km for common tern and less than 5km for little tern. Terns are vulnerable to depletion of stocks of fish such as sandeels and Clupeidae (Furness & Tasker,

	2000; Furness, 2002; Stienen *et al*, 2000; Garthe & Flore, 2007; Jennings *et al*, 2012; Dänhardt & Becker, 2011; Monaghan *et al*, 1992)). Terns are also sensitive to changes in water turbidity (Cook & Burton, 2010; Brenninkmeijer *et al*, 2002) and declines in Sandwich tern populations in the Netherlands have been associated with dredging of sediments (Essink 1999). Sandwich and Arctic terns are also potentially sensitive to bycatch in longline fisheries (ICES, 2013). Tern populations may potentially be impacted by climate change, both through impacts on fish prey species (Arnott & Ruxton, 2002) and the effects of increased storminess and sea level rise on coastal nest sites (Mendel *et al*, 2008) or on levels of kleptoparistism by gulls (Stienen *et al*, 2001). Arctic tern populations in the UK, which are largely confined to Scotland, have in particular been identified as highly susceptible to climatic fluctuations or change (Möller *et al*, 2006; Huntley *et al*, 2007; Pearce-Higgins *et al*, 2011; Russell *et al*, 2015). Site-based protection of core marine foraging areas for breeding terns from existing colony SPAs enhances resilience of these important colonies by safeguarding both the marine habitats supporting key prey species and the birds' access to these prey. Site-based protection for foraging terns complements wider seas measures, including fisheries management.
Auks (common guillemot, razorbill and Atlantic puffin) (breeding & non-breeding)	The UK holds notable proportions of the relevant biogeographic populations of all three auk species in both the breeding and non-breeding seasons (razorbill c.20% & c.30%; guillemot c.30 & c.67%; Atlantic puffin c.10% & c.5%) (Mitchell *et al*, 2004; Furness 2015) and Scotland holds the majority of the GB breeding populations (85% razorbill and puffin, 88% guillemot) (Mitchell *et al*, 2004). All three auk species are dependent for successful chick rearing on high quality shoaling fish, such as sandeels, sprat or herring (Wanless *et al*, 2005; Harris *et al*, 2007; Miles *et al* 2015). They are vulnerable to reductions in availability of such prey (e.g. Harris & Wanless 2011) arsing from overfishing of food fish stocks (Tasker *et al*, 2000; Breton & Diamond, 2014) or associated with climate change (Durant *et al*. 2003, Sandvik *et al*. 2005, Wanless *et al*, 2005). Climate change may also affect susceptibility to winter "wrecks" (Forrester *et al* 2007; Jessop, 2014) and puffins are also susceptible to flooding of their nest burrows during exceptional rainfall events during the breeding season. Breeding populations of razorbill, guillemot and puffin are predicted to suffer moderate or high magnitude declines in response to climate change over the next 40 years under a medium emissions scenario (Pearce-Higgins *et al* 2011) and breeding populations of Atlantic puffin in Europe are predicted to experience range contraction as a consequence of climate change (Russell *et al*, 2015). All three species are susceptible to bycatch in set (gill) net fisheries (Tasker *et al*. 2000; Žydelis *et al*,

	2013; Atkins & Heneman, 1987; Murray *et al*, 1994) and are identified as among the most potentially vulnerable species to fisheries bycatch in UK waters given their susceptibility to entanglement (Bradbury *et al*, 2017). However, but there is no systematic data from which to assess bycatch rates or impacts (*ibid*). Auks are also susceptible to large scale mortality in major oil spills (Mendel *et al* 2008; Harris & Wanless 2011), although impacts on population demographics are complex (Votier *et al*, 2008). Guillemots and razorbills have been identified as showing sensitivity to visual disturbance associated with shipping (Mendel *et al* 2008) and as being potentially at relatively high risk of collision with tidal turbines (Furness *et al* 2012; McCluskie *et al*., 2012). Razorbills (non-breeding) have also been identified as at risk of displacement as a result of offshore wind farm developments (Furness *et al* 2013). However, empirical data on the significance of such impacts are currently lacking Representation of these auk species in the Scottish pSPA network is desirable given vulnerability to a range of anthropogenic pressures, some of which (e.g. entanglement in set nets, displacement associated with marine development) could be managed through provision of site-based protection encompassing supporting habitats (e.g. foraging locations) (Furness, 2016). Other anthropogenic pressures (e.g. reduced availability of key prey associated with fisheries and/or climate change) exist at the wider ecosystem level and are therefore most appropriately managed through wider seas measures. Non-breeding adult common guillemots tend to remain near their breeding colonies throughout the year, but in the non-breeding season, razorbill and Atlantic puffin have widely dispersed and unpredictable distributions, meaning that a significant marine SPA provision for these species outwith the breeding season is unrealistic.

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